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Recent Trends in Coastal Environmental Quality: Results from the Mussel Watch Project

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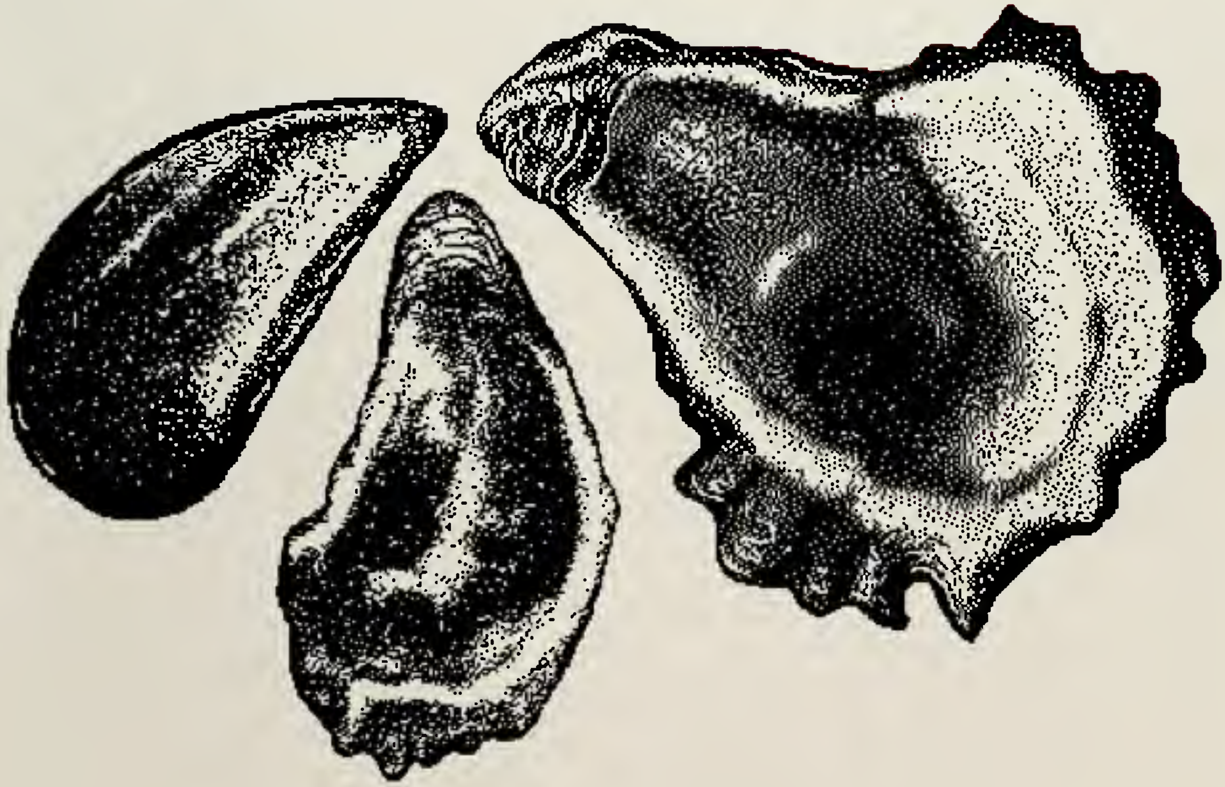

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Recent Trends in Coastal Environmental Quality: Results from the Mussel Watch Project 1986 to 1993

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INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) created the National Status and Trends (NS&T) Program in 1984 to address national concerns over the quality of the coastal marine environment. One of its goals is to assess spatial distributions and temporal trends in chemical contamination. To meet that goal, the NS&T Mussel Watch Project was formed in 1986 to measure concentrations of a broad suite of trace metals and organic chemicals in surface sediments and whole soft-parts of mussels and oysters collected from about 300 coastal and estuarine sites. Here we summarize results from eight years of annually collecting and analyzing mollusks. The most important of these results indicates that contamination is decreasing for chemicals whose use has been banned, such as chlorinated hydrocarbons, or severely curtailed, such as cadmium. For other chemicals there is no evidence, on a national scale, for either an increasing or decreasing trend. There are some sites where trace element concentrations are both "high" and increasing.

CHEMICALS MONITORED

The elements and groups of organic compounds listed in Table 1[2] are the subjects of this report. The elements are all potential contaminants in the sense that their concentrations in the environment have been altered by human activities (Nriagu, 1989). Three of the organic groups, total DDT (∑DDT), total chlordane (∑Cdane), and total dieldrin (∑Dield) are chlorinated pesticides. Uses of DDT and dieldrin were banned in the United States in the 1970s. Chlordane use on U.S. crops ended in 1983, and its use for termite control effectively ended in 1988 (Shigenaka, 1990). Polychlorinated biphenyls (∑PCB) are a mixture of chlorinated compounds first used in the 1920s for a number of industrial purposes. Their high heat capacities and low dielectric constants were exploited for use in electrical transformers and capacitors. PCB use in the United States began being phased out in 1971, and a ban on new uses took effect in 1976. Large changes in concentrations of ∑DDT and ∑PCB were seen at some locations in the 1970s following bans on their further use (Mearns et al., 1988), but the compounds are still found in tissues and sediments. PCB-containing devices are still in use, chlordane remains in the ground as a termiticide, and DDT remains in the environment because of its resistance to degradation. The pesticide DDT is metabolized to DDE and DDD in the environment, but those compounds degrade very slowly under environmental conditions. The three butyltin compounds, aggregated as ∑BT, are found in mollusks because tributyltin (TBT) has been used as an antifouling agent in the paint commonly used on boats and some underwater marine facilities. Its use on vessels under 75 feet long was banned in 1988 by the U.S. Organotin Anti-Fouling Paint Act. Tributyltin degrades to dibutyltin and then monobutyltin, which itself does not persist, so unlike the chlorinated compounds, ∑BT should degrade relatively quickly (Seligman et al., 1988). Consequently, the NS&T Program should find substantial decreases in ∑BT concentrations during the next several years.

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[2] All tables and figures are located at the end of this report.

Polycyclic aromatic hydrocarbons (PAHs) are like metals in that they occur naturally. They are found in fossil fuels such as coal and oil. Their existence, however, is also attributable to humans because they are produced when organic matter is burned. A multitude of human activities, from coal and wood burning to waste incineration, create PAH compounds in excess of those that would exist naturally. In addition, human production, transport, and use of oil release more PAHs to the environment, on a globally averaged basis, than does natural seepage (NRC, 1985). Because they are relatively more concentrated in oil than in combustion products, 2- and 3-ring PAH compounds, especially those with alkyl groups on a benzene ring such as methyl- and dimethylnaphthalene and methylphenanthrene (Table 1), are sometimes classified separately from the higher molecular-weight 4- and 5-ring PAH compounds. Since high concentrations of both types of compounds tend to be found in the same locations, all PAH compounds have been combined into a single group in this report.

All of these trace metals and groups of organic compounds can be acutely or chronically toxic to marine life and to humans under some conditions. On the other hand, while the elements arsenic, copper, nickel, selenium, and zinc can be toxic at high concentrations, they are also essential in small quantities to the maintenance of life (Nielsen, 1988).

SAMPLING SITES

The NS&T Mussel Watch Project is national in scale and sampling sites should be representative of large areas rather than the small-scale patches of contamination commonly referred to as "hot spots." To this end, no sites were knowingly selected near waste discharge points. Furthermore, since the Mussel Watch Project is based on analyzing indigenous mussels and oysters, a site must support a sufficient population of these mollusks to provide annual samples.

NS&T sampling sites are not uniformly distributed along the coast. Within estuaries and embayments, they average about 20 kilometers (km) apart, while along open coastlines the average separation is 70 km. Almost half of the sites were selected in waters near urban areas, within 20 km of population centers in excess of 100,000 people. This choice was based on the assumptions that chemical contamination is higher, more likely to cause biological effects, and more spatially variable in these waters than in rural areas.

By 1993, 255 sites had been sampled, but not all sites in all years. The numbers sampled in each year from 1986 through 1993 were 145, 147, 174, 185, 214, 192, 195, and 169, respectively. All are plotted in Figure 1 and listed in Table 2, which indicates years of sampling. Temporal trend detection improves as more years are sampled, so trends discussed here are based on data from the 154 sites sampled in at least six of the eight years.

SPECIES COLLECTED

Since no single species of mollusk is common to all coasts, it has been necessary to collect seven different ones: the blue mussel *Mytilus edulis* on the East Coast from Maine to Cape May, NJ; the American oyster *Crassostrea virginica* from Delaware Bay southward and throughout the Gulf of Mexico; the mussels *M. edulis* and *M. californianus* on the West Coast; the oyster *Ostrea sandvicensis* in Hawaii; the zebra mussel *Dreissena polymorpha* at sites in the Great Lakes; the mangrove oyster *Crassostrea rhizophorae* in Puerto Rico; and the smooth-edged jewel box *Chama sinuos* at the one site in the Florida Keys.

The multitude of species complicates comparisons among sites, because different species can have different chemical concentrations even if the surrounding environments are identical. At sites in Long Island Sound where it was possible to sample both mussels and oysters, *M. edulis* and *C. virginica*, two trace elements, Cu and Zn, were enriched in oysters by more than a factor of 10 relative to mussels, while Pb was more than three times higher in mussels. For other elements and for organic compounds no strong species-effect was observed. Similarly, at a site off the Columbia River two species of mussels, *M. edulis* and *M. californianus*, were sampled. In that case there were no important concentration differences for any element or organic compound.

There has been some discussion recently among malacologists over whether the West Coast organism called *M. edulis* is actually *M. galloprovincialis* in California and *M. trossulus* towards the north. In fact, the three species may be strains of a single *Mytilus* species (Seed, 1992). Given this uncertainty, the mussels collected at the Columbia River site may have been *M. trossulus* or even *M. galloprovincialis* instead of *M. edulis*. However, the lack of concentration differences between two *Mytilus* species at that site has been taken to validate comparisons among all marine mussels collected in the program.

DATA AVAILABILITY

Except in the Great Lakes, mollusks are collected in the months of November through March with each site occupied within 30 days of a prescribed date. In the Great Lakes, collections are made in August. From 1986 through 1991, six separate composite samples of 20 oysters or 30 mussels were collected at each site. Three composites were homogenized for trace element analyses and three for trace organic analyses. That protocol still applies whenever a site is sampled for the first time. Otherwise, since 1992 only two composite samples have been collected; one for each analytical category. The concentrations used in this report are the arithmetic means of three concentrations measured prior to 1992 or the single value measured since then. An appendix, available upon request, contains all the mean concentrations of elements or of groups of organic compounds. A computer disk with all the raw data is available, and the raw data can also be obtained on the Internet using the Universal Resource Locator at http://www-orca.nos.noaa.gov/projects/nsandt/nsandt.html.

LOCATIONS WHERE CONCENTRATIONS ARE HIGH

Using the 1990 data, because it included more sites than any other single year, O'Connor (1992) calculated the following "high" concentrations as the mean plus one standard deviation of the lognormal distribution of concentrations among sites.

Chemical	"High" concentration	Chemical	"High" concentration	
ΣDDT	120 ppb-dry	mercury (Hg)	0.24 ppm-dry	
ΣPCB	470	nickel (Ni)	3.3	
ΣChlordane	31	selenium (Se)	3.5	
ΣDieldrin	15	cadmium (Cd)	5.7	
ΣPAH	1020	arsenic (As)	17	
ΣBT	350 ppb(as Sn)	copper (Cu)[1]	13 (mu)	490(oy)
		zinc (Zn)[1]	210 (mu)	6500(oy)
		lead (Pb)[2]	4	

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[1] The "highs" for copper and zinc must be calculated separately for mussels (mu) and oysters (oy).

[2] The "high" for lead in mussels is 4.3 ppm and 0.96 in oysters, the value listed is the lowest public health guideline (see following page).

These "highs" serve as a basis for categorizing sites but, as will be discussed, "high" concentrations are not always indicative of environmental contamination. Because organic compounds showed no concentration differences between mussels and oysters or between two species of mussels, there is some confidence in comparing concentrations of such compounds from all sites, including sites in Hawaii, Puerto Rico, the Great Lakes, and the Florida Keys, even though species from those sites could not be compared with others in terms of their ability to accumulate chemicals. On the other hand, we know that all species are not the same with regard to accumulation of all trace elements.

For some chemicals there is a tendency for concentrations to decrease with time, so comparisons of concentrations among sites are limited to concentrations measured since 1990. The results are listed in Table 3 and plotted in Figures 2 through 13. If a site was sampled in 3 or 4 of the years from 1990 through 1993 and a "high" concentration was found in only one year, that site is not shown on the corresponding figure for that chemical. Such occurrences usually mean that the concentrations were close to but usually below the "high" value. If the site was sampled only once or twice over those years, then even a single exceedance qualified it for inclusion on a figure. In effect, sites are plotted in Figures 2 to 15 if the concentration of the given chemical exceeded the "high" value in at least half the years since 1990 in which the site was sampled.

Despite all those qualifications, two general features about the spatial distributions of "high" concentrations are worth noting. First, that "high" concentrations can often be attributed to human activities because they are found where human populations are high. Second, there are many instances where trace elements are at "high" concentrations for purely natural reasons and are not evidence of contamination.

Chlorinated hydrocarbons are synthesized chemicals with no natural sources. It is evident in Table 3 and Figures 2(ΣPCB), 3(ΣDDT), 4(ΣChlordane), and 5(ΣDieldrin) that their concentrations tend to be high in urban areas. The connection of high concentrations with population centers also holds for polycyclic aromatic hydrocarbons (Fig. 6(ΣPAH)), mercury (Fig. 7) and zinc (Fig. 8). Butyltin (Fig. 9) concentrations are high at sites near marinas, which are usually near populated areas.

For some of the other elements, "high" concentrations are found near Boston, New York, San Diego, Los Angeles, Honolulu, and other urban centers, indicating contamination. For nickel, selenium, copper, zinc, cadmium, and arsenic, however, at least some of the "high" concentrations are natural. Finding such concentrations for nickel (Fig. 10), selenium (Fig. 11), and copper (Fig. 12) at every site in the Great Lakes most likely does not indicate environmental enrichment with those elements but, rather, a strong affinity for those elements by the species *D. polymorpha* and the fact that trace elements are more bioavailable in fresh than in marine waters (Cross and Sunda, 1985). The nickel concentrations on the West Coast may be high simply because rocks in that area are enriched relative to those elsewhere in the U.S. (USGS, 1981). High concentrations of cadmium (Fig. 13) on the West Coast have been attributed to upwelling of deep ocean water (Goldberg et al., 1983) because such water naturally contains higher concentrations of cadmium than surface ocean water. Elevated arsenic (Fig. 14) levels in the southeast have been attributed to the natural occurrence of economically valuable phosphate deposits in that part of the country (O'Connor, 1992). The high selenium in San Francisco Bay may reflect soil enrichment with that element in California's Central Valley. Drainage from agricultural soils into the Kestersen National Wildlife Refuge has caused selenium poisoning among fish-eating birds (Presser et al., 1990). However, selenium and cadmium are both also high at sites along the Gulf Coast west of the Mississippi River and we have no data on natural enrichments either in that area or in the Mississippi River.

EXCEEDANCES OF PUBLIC HEALTH LIMITS

Concentrations were placed in the "high" category on the basis of their magnitude relative to other concentrations. There is no reason to suppose that such concentrations cause harm to marine organisms or to man. With two exceptions at single sites, lead is the only chemical measured in the Mussel Watch Project whose concentration was above a public health guideline.

There are U.S. Federal Drug Administration standards* for chlorinated hydrocarbons and for mercury, such that fish and shellfish with higher concentrations are prohibited from interstate commerce. None of the standards are exceeded for mercury, ∑DDT, ∑dieldrin, or ∑chlordane at any site in any year. The 10,000 ng/g (dry-weight) standard for ∑PCB was exceeded in 1989 at one site in Buzzards Bay, MA but not in any other year. In 1993, the FDA issued human consumption guidelines for concentrations of five trace elements in molluscan and crustacean shellfish that vary with the age of consumer and rate of consumption. For three of those elements, arsenic, chromium, and nickel, there are no cases where mussels or oysters collected in the Mussel Watch Program exceeded even the most stringent guideline. In 1991, the only year it was successfully sampled, the site in Lake Pontchartrain near New Orleans yielded oysters whose cadmium concentrations exceeded the lowest guideline.

For Pb there were many exceedances. The FDA guidelines converted to a dry weight basis are:

	Consumption rate	
Group	Mean	Upper 90th percentile
Children (2-5)	7.5 ppm-dry	4.0 ppm-dry
Pregnant women	10.5	7.0
Adults	31.5	21.0

The last of the figures on spatial distribution of high concentrations is for lead (Fig. 15), and is based on a "high" concentration of 4 ppm. This value is close to the "high" for mussels but is also the lowest public health guideline, applicable to children consuming mollusks at a rate of 8 grams per day. It is evident on Table 4 that progressively fewer sites have mollusks with concentrations at the higher guideline levels. The distribution of sites with high lead concentrations is like those for organic contaminants and mercury in that, for the most part, high concentrations are found in the vicinity of population centers. So, as with those chemicals, high concentrations are attributable to human activities.

TEMPORAL TRENDS

Chemical concentrations in mussels and oysters are determined by the extent to which the organisms accumulate chemicals from the food they filter out of their surrounding water and from the water itself. When chemical concentrations increase or decrease in their surroundings, the organisms are capable of increasing or decreasing the corresponding concentrations in their tissues (see for example, Roesijadi et al., 1984; Pruell et al., 1987). This, and the fact that they are immobile, make them ideal for monitoring changes in chemical concentrations at fixed sites.

A trend is a correlation between concentration and time. Over a time span as short as eight years, we are not likely to decipher cycles in concentrations, so the trends sought in the Mussel Watch data are linear correlations between ranks of concentration and time. Specifically, the data are examined to see if concentrations are changing in a single direction, up or down.

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*FDA guidelines are given as concentrations on a wet-weight basis. They have been multiplied by five for application to Mussel Watch data which are concentrations in terms of dry-weight. This uses the conventional assumption that the soft-parts of organisms are 80% water by weight. (Actually, mussels and oysters average closer to 85% water which would require multiplying the criteria by 7.5 and, in effect, finding fewer public health exceedances than would the conventional assumption.)

The statistical test is based only on the rankings of concentrations. For example, the rankings of cadmium concentrations at the site outside Hempstead Harbor River in Long Island Sound were:

Year	86	87	88	89	90	91	92	93
Rank	2	1	3	4	5	8	6	7

where the highest value, rank 1, occurred in 1987 and the lowest, rank 8, occurred in 1991. The correlation coefficient between these ranks and years is -0.905. The coefficient is negative because concentrations are decreasing as years increase. The correlation is statistically significant because the coefficient is greater than 0.738 (or less than -0.738) meaning that there is less than a 5% chance that rankings could fall out in that order purely by chance. The conclusion is that cadmium concentrations are decreasing at this site. If the ranking had been:

Year	86	87	88	89	90	91	92	93
Rank	1	2	3	4	5	6	7	8

the coefficient would have been -1.000, indicating a perfect correlation, but perfection is not necessary for a determination that a trend exists. Note that the actual concentrations were not used. The actual concentrations were (in ppm-dry):

Year	86	87	88	89	90	91	92	93
Conc	3.23	3.67	2.60	1.93	1.68	1.00	1.39	1.37

but even if they could had been:

Year	86	87	88	89	90	91	92	93
Conc	13.2	48.7	9.60	7.93	7.90	0.40	0.50	0.45

the rank order would have been the same, the Spearman correlation would have been the same, and the same conclusion would have been drawn.

Proceeding with site-by-site and chemical-by-chemical non-parametric correlations, we have calculated correlations for 14 chemicals at the 154 sites with 6 or more years of data. Table 5 from O'Connor (1995) summarizes the results by indicating chemicals for which there is a 90 or 95% probability of a correlation between concentration and year, and whether that trend is an increase (I) or decrease (D). For ΣPAH, the numbers of years are 4 to 6 rather than 6 to 8, and for butyltin the numbers of years are 5 or less. These fewer numbers of years have been taken into account when assigning 90 and 95% levels of confidence.

The 90% probability trends are included for two reasons. First, because there are fewer years for ΣPAH and ΣBT, relaxed statistical criteria are needed to identify trends. Secondly, inclusion of 90%-level trends highlights similarities among groups of sites. For example, the decreasing concentrations of Cd and Cu in Long Island Sound are emphasized by including the Huntington Harbor site where the decrease found at three other sites with 95% certainty is also found but with 90% certainty.

The most common result in Table 5 is a lack of trends. Among the 2156 combinations of 14 chemicals at 154 sites, there are only 41 increases and 217 decreases at the 95% level of confidence. On a per-chemical basis the trends, with 95% confidence, are as follows:

Chem	Incr.	Dec.	Chem	Incr.	Dec.
ΣCdane	0	43	As	5	14
ΣDDT	0	24	Cd	3	20
ΣDield	0	19	Cu	5	17
ΣPCB	0	26	Hg	7	8
ΣPAH	2	3	Ni	4	5
ΣBT	0	11	Pb	7	8
			Se	2	12
			Zn	6	7

Given a 5% probability of random data showing trends, there could be 54 increases and 54 decreases that are not real trends. Conceivably, none of the 41 increases are real. The important point, however, is that decreases greatly outnumber increases. Decreases exceed increases by a factor of three or more for all the chlorinated hydrocarbons, tributyltin, arsenic, cadmium, copper, and selenium.

Annual data have been aggregated to national geometric means in Table 6 (O'Connor, 1995) where, because of species differences, concentrations in mussels have been separated from those in oysters for Cu, Pb, and Zn. Decreasing trends at the 95% confidence level and at this national level of aggregation exist for As, Cd, Cu (in mussels), all the chlorinated organics, and ΣBT. Except for selenium, this list highlights the same decreasing trends found by counting trends site-by-site. National geometric means show trends for copper in mussels but not oysters, which is consistent with the site-by-site data where 16 of the 17 decreases were at mussel-sites.

Decreasing trends are not unexpected. All the monitored chlorinated hydrocarbons have been banned for use in the United States and tributyltin has been banned as a biocide on recreational boats. For cadmium and arsenic there have been decreases in their uses.

Annual consumption of Cd in the U.S. averaged 4069 metric tons per year (mt y^{-1}) for 1986 through 1989, dropped by 25% in 1990, and averaged 3068 mt y^{-1} for 1990 through 1993 (DOI, 1994). While the use of cadmium in rechargeable batteries is growing, the dramatic decrease in overall use is due to drops in uses for electroplating onto metal surfaces for rustproofing automobile parts, as a stabilizer in plastics, and its use in pigments. Annual consumption of arsenic in the U.S. has remained fairly steady at around 22,000 mt y^{-1} since 1986. Its primary use is as an ingredient in wood preservatives, which has remained fairly stable, but there has been a decline in its agricultural uses. Between 1986 and 1991, the annual agricultural use varied between 4200 and 5000 mt y^{-1}, but in 1992 and 1993, respectively, only 3900 and 3000 mt y^{-1} of arsenic were used. There has been no parallel decrease in use of copper within the United States. Possibly, its decreasing trend indicates increased success in control of copper emissions from many sources.

While concentration data themselves do not indicate whether trace element levels in mollusks are affected by human activity, the existence of monotonic trends like those identified here are likely due to activities that are increasing or decreasing an element's concentration in the environment. All sorts of natural factors, either internal, such as mollusk growth or reproduction, or external, such as temperature or rainfall in the period proceeding collection, can affect chemical concentrations (Phillips, 1980). Such natural factors can make trends in chemical concentrations difficult to detect. However, it would be difficult to find a natural factor with year-to-year changes that would cause detection of a monotonic trend in chemical concentrations. The trends, therefore, are most likely due to human actions.

SITES WITH "HIGH" AND INCREASING CONCENTRATIONS

It is comforting and expected that where trends exist they are, by far, mostly decreases. Increasing trends are uncommon and most of those identified on Table 5 may only be chance sequences of concentrations. However, where such sequences include a concentration in the "high" range, the site deserves attention. The following listing of such sites and chemicals includes trends in parenthesis that were found with only a 90% level of confidence and sites where the "high" concentration was found in only one year since 1990. It should also be noted that the highest concentrations were usually not those measured in the most recent year. Nonetheless, these are trends and, unless shown otherwise, should be interpreted as indicating that ongoing human activity is increasing chemical contamination.

General Location	Specific Location	State	High Chemical
Penobscot Bay	Sears Island	ME	(Hg)
Block Island Sound	Block Island	RI	As
Hudson/Raritan Est.	Upper Bay	NY	Cu, (Zn)
New York Bight	Shark River	NJ	(Hg)
Delaware Bay	Ben Davis Point Shoal	NJ	(Ni)
Quinby Inlet	Upshur Bay	VA	(ΣPAH)
St. Johns River	Chicopit Bay	FL	(As)
Naples Bay	Naples Bay	FL	Cu
Choctawhatchee Bay	Postil Point	FL	Pb
Mobile Bay	Hollingers Is. Chan.	AL	Zn
Mississippi Sound	Biloxi Bay	MS	Cd
Lake Borgne	Malheureux Point	LA	Cd,Hg,(Zn)
Mississippi River	Tiger Pass	LA	Cd
Matagorda Bay	Lavaca River Mouth	TX	Se
Point Loma	Lighthouse	CA	Hg, Ni
Pacific Grove	Lovers Point	CA	(Cd)
San Francisco Bay	Emeryville	CA	(Cd),Hg
Point Arena	Lighthouse	CA	Hg
Crescent	Point St. George	CA	(As)
Juan de Fuca Strait	Cape Flattery	WA	Se
Honolulu Harbor	Keehi Lagoon	HI	Ni

CONCLUSIONS

There are many more decreases than increases in chemical concentrations between 1986 and 1993. The chemicals for which most of these trends exist are: chlorinated hydrocarbons, whose use has been banned; tributyltin, whose use as an antifoulant on recreational boats has been banned; cadmium and arsenic, whose uses have been severely curtailed; and copper, whose use has not deceased but whose discharges apparently have diminished. Lead is the only chemical showing concentrations in excess of public health guidelines. There are some sites where chemicals are at high concentrations (though not necessarily threatening to marine organisms or man) and may be increasing.

ACKNOWLEDGMENTS

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Table 1. Chemicals discussed in this report.

Elements:

As, Cd, Cu, Hg, Ni, Pb, Se, Zn

Goups of Organic Compounds:

∑PCB = sum of concentrations at each level of chlorination or, equivalently and since 1988, twice the sum of concentrations of these18 congeners;
PCB8+PCB18+PCB28+PCB44+PCB52+PCB66+PCB101+PCB105+PCB118+PCB128+PCB138+PCB153+PCB170+PCB180+PCB187+PCB195+PCB206+PCB209

∑DDT = sum of concentrations of ortho and para forms of parent and metabolites;
opDDE+ppDDE+opDDD+ppDDD+opDDT+ppDDT

∑Cdane = sum of concentrations of four compounds;
alpha-chlordane+trans-nonachlor+heptachlor+heptachlor-epoxide

∑Dieldrin = sum of concentrations of two compounds; aldrin + dieldrin

∑BT = sum of concentrations of parent compound and metabolites;
monobutyltin+dibutyltin+tributyltin (concentrations in terms of tin)

∑PAH = sum of concentrations of 24 compounds*;
naphthalene+ 2-methylnaphthalene+ 1-methylnaphthalene+ biphenyl+ 2,6-dimethylnaphthalene+ acenaphthene+ acenaphthylene + 1,6,7-trimethylnaphthalene+ fluorene+ phenanthrene+anthracene+ 1-methylphenanthrene+ fluoranthene+ pyrene+ benz[*a*]anthracene+ chrysene+ benzo[*b*]fluoranthene+ benzo[*k*]fluoranthene+ benzo[*e*]pyrene+ benzo[*a*]pyrene+perylene+ dibenzanthracene+ indeno[1,2,3-*cd*]pyrene+ benzo[*ghi*]perylene

* Six of these compounds did not begin to be measured until 1988. Analysis for trends in tPAH concentrations have not used data from 1986 or 1987.

Table 2. Site codes, general and specific names, states, latitudes and longitudes (decimal degrees), species, total and specific years sampled.

SITE	General Location	Specific Location	State	Sp.	Longitude W	Latitude N	ΣYrs	86	87	88	89	90	91	92	93
PBPI	Penobscot Bay	Pickering Island	ME	me	68.7342	44.2647	8	x	x	x	x	x	x	x	x
PBSI	Penobscot Bay	Sears Island	ME	me	68.8897	44.4522	8	x	x	x	x	x	x	x	x
MSSP	Merriconeag Snd.	Stover Point	ME	me	69.9953	43.7580	6			x	x	x	x	x	x
CAKP	Cape Arundel	Kennebunkport	ME	me	70.4747	43.3478	5				x	x	x	x	x
CAGH	Cape Ann	Gap Head	MA	me	70.5952	42.6608	7		x	x	x	x	x	x	x
SHFP	Salem Harbor	Folger Point	MA	me	70.8670	42.5188	6			x	x	x	x	x	x
MBNB	Massachusetts Bay	Nahant Bay	MA	me	70.9068	42.4217	2					x			x
BHDI	Boston Harbor	Deer Island	MA	me	70.9733	42.3583	8	x	x	x	x	x	x	x	x
BHDB	Boston Harbor	Dorchester Bay	MA	me	71.0383	42.3042	6	x	x	x	x	x			x
BHHB	Boston Harbor	Hingham Bay	MA	me	70.8877	42.2742	8	x	x	x	x	x	x	x	x
BHBI	Boston Harbor	Brewster Island	MA	me	70.8780	42.3425	8	x	x	x	x	x	x	x	x
MBNR	Massachusetts Bay	North River	MA	me	70.7402	42.1608	2					x			x
DBCI	Duxbury Bay	Clarks Island	MA	me	70.6362	42.0147	5				x	x	x	x	x
CCNH	Cape Cod	Nauset Harbor	MA	me	69.9483	41.7947	5				x	x	x	x	x
BBNI	Buzzards Bay	Naushon Island	MA	me	70.7415	41.5128	3					x	x	x	
BBWF	Buzzards Bay	West Falmouth	MA	me	70.6728	41.6128	3					x	x	x	
BBCC	Buzzards Bay	Cape Cod Canal	MA	me	70.6170	41.7395	4				x	x	x	x	
BBAR	Buzzards Bay	Angelica Rock	MA	me	70.8783	41.5870	8	x	x	x	x	x	x	x	x
BBRH	Buzzards Bay	Round Hill	MA	me	70.9253	41.5408	5	x	x	x	x	x			
BBGN	Buzzards Bay	Goosebury Neck	MA	me	71.0223	41.4807	8	x	x	x	x	x	x	x	x
NBDI	Narragansett Bay	Dyer Island	RI	me	71.2895	41.6033	6	x	x	x	x	x			x
NBPI	Narragansett Bay	Patience Island	RI	me	71.3522	41.6562	5				x	x	x	x	x
NBDU	Narragansett Bay	Dutch Island	RI	me	71.3928	41.5013	6	x	x		x		x	x	x
BIBI	Block Island Sound	Block Island	RI	me	71.5857	41.1900	7		x	x	x	x	x	x	x
LICR	Long Island Sound	Connecticut River	CT	me	72.3417	41.2638	7	x	x	x	x	x	x	x	
LINH	Long Island Sound	New Haven	CT	me	72.9445	41.2567	8	x	x	x	x	x	x	x	x
LIHR	Long Island Sound	Housatonic River	CT	me	73.1097	41.1678	7	x	x	x	x	x	x	x	
LISI	Long Island Sound	Sheffield Island	CT	me	73.4128	41.0567	6	x	x	x	x	x			x
LIMR	Long Island Sound	Mamaroneck	NY	me	73.7005	40.9412	7	x	x	x	x	x	x	x	
LITN	Long Island Sound	Throgs Neck	NY	me	73.8012	40.8195	8	x	x	x	x	x	x	x	x
LIHH	Long Island Sound	Hempstead Harbor	NY	me	73.6690	40.8523	8	x	x	x	x	x	x	x	x
LIHU	Long Island Sound	Huntington Harbor	NY	me	73.4312	40.9167	7	x	x	x	x	x	x	x	
LIPJ	Long Island Sound	Port Jefferson	NY	me	73.0920	40.9595	8	x	x	x	x	x	x	x	x
LIGB	Long Island	Gardiners Bay	NY	me	72.1113	40.9983	5				x	x	x	x	x
MBTH	Moriches Bay	Tuthill Point	NY	me	72.7562	40.7775	8	x	x	x	x	x	x	x	x
LIFI	Long Island	Fire Island Inlet	NY	me	73.2860	40.6280	1					x			
LIJI	Long Island	Jones Inlet	NY	me	73.5908	40.5968	2					x			x
HRJB	Hudson/Raritan Estu	Jamaica Bay	NY	me	73.8980	40.5688	8	x	x	x	x	x	x	x	x
HRUB	Hudson/Raritan Estu	Upper Bay	NY	me	74.0425	40.6897	7	x	x	x	x	x	x	x	
HRLB	Hudson/Raritan Estu	Lower Bay	NY	me	74.0522	40.5662	6	x	x	x	x	x			x
HRRB	Hudson/Raritan Estu	Raritan Bay	NJ	me	74.1572	40.5065	1					x			
NYSH	New York Bight	Sandy Hook	NJ	me	74.0450	40.4878	7	x	x	x	x	x	x	x	
NYLB	New York Bight	Long Branch	NJ	me	73.9760	40.2947	6	x	x	x	x	x			x
NYSR	New York Bight	Shark River	NJ	me	74.0063	40.1863	8	x	x	x	x	x	x	x	x
BIBL	Barneget Inlet	Barnegat Light	NJ	me	74.0988	39.7587	5			x	x	x	x	x	
AIAC	Absecon Inlet	Atlantic City	NJ	me	74.4080	39.3692	5			x	x	x	x	x	
DBCM	Delaware Bay	Cape May	NJ	me	74.9653	38.9820	5				x	x	x	x	x
DBFE	Delaware Bay	False Egg Island Point	NJ	cv	75.1908	39.2118	6	x	x	x		x	x	x	
DBBD	Delaware Bay	Ben Davis Point Shoal	NJ	cv	75.2822	39.2655	6	x	x	x	x	x			x
DBAP	Delaware Bay	Arnolds Point Shoal	NJ	cv	75.4313	39.3848	6	x	x	x		x	x	x	
DBHC	Delaware Bay	Hope Creek	NJ	cv	75.4933	39.4267	1				x				
DBWB	Delaware Bay	Woodland Beach	DE	cv	75.4570	39.3320	1				x				
DBKI	Delaware Bay	Kelly Island	DE	cv	75.3550	39.2028	7	x	x	x	x	x	x	x	
DBCH	Delaware Bay	Cape Henlopen	DE	me	75.1237	38.7880	5				x	x	x	x	x
CBBO	Chesapeake Bay	Bodkin Point	MD	cv	76.4012	39.1600	3				x	x			x
CBMP	Chesapeake Bay	Mountain Point Bar	MD	cv	76.4122	39.0737	8	x	x	x	x	x	x	x	x
CBHP	Chesapeake Bay	Hackett Point Bar	MD	cv	76.4167	38.9728	7	x	x	x	x	x	x	x	
CBCP	Chesapeake Bay	Choptank River	MD	cv	76.1200	38.6053	5				x	x	x	x	x
CBHG	Chesapeake Bey	Hog Point	MD	cv	76.3978	38.3123	7	x	x	x	x	x	x	x	
PRSP	Potomec River	Swan Point	MD	cv	76.9337	38.2817	2				x	x			
PRMC	Potomac River	Mattox Creek	VA	cv	76.9553	38.2187	1					x			
PRRP	Potomac River	Ragged Point	VA	cv	76.5978	38.1562	5				x	x	x	x	x
CBIB	Chesapeake Bay	Ingram Bay	VA	cv	76.2843	37.7938	2	x	x						
RRRR	Rappahannock River	Ross Rock	VA	cv	76.7905	37.9013	5				x	x	x	x	x
CBDP	Chesapeake Bay	Dandy Point	VA	cv	76.2955	37.1007	8	x	x	x	x	x	x	x	x
CBJR	Chesapeake Bay	James River	VA	cv	76.6113	37.0678	2				x	x			
CBCC	Chesapeake Bay	Cape Charles	VA	cv	76.0198	37.2848	7	x	x	x	x	x	x	x	
CBCI	Chincoteague Bay	Chincoteague Inlet	VA	cv	75.3767	37.9417	8	x	x	x	x	x	x	x	x
QIUB	Quinby Inlet	Upshur Bay	VA	cv	75.7230	37.5308	7	x	x	x	x	x	x	x	

Table 2 continued.

SITE	General Location	Specific Location	State	Sp.	Longitude W	Latitude N	ΣYrs	86	87	88	89	90	91	92	93
RSJC	Roanoke Sound	John Creek	NC	cv	75.6330	35.8912	7	x	x	x	x	x	x	x	
PSWB	Pamlico Sound	Wysocking Bay	NC	cv	76.0575	35.4112	8	x	x	x	x	x	x	x	x
PSPR	Pamlico Sound	Pungo River	NC	cv	76.4492	35.3247	5				x	x	x	x	x
PSNR	Pamlico Sound	Neuse River	NC	cv	76.5245	35.1122	5				x	x	x	x	x
PSCH	Pamlico Sound	Cape Hatteras	NC	cv	75.7160	35.2062	4					x	x	x	x
BIPI	Beaufort Inlet	Pivers Island	NC	cv	76.6755	34.7183	4					x	x	x	x
CFBI	Cape Fear	Battery Island	NC	cv	78.0083	33.9153	8	x	x	x	x	x	x	x	x
WBLB	Winyah Bay	Lower Bay	SC	cv	79.1963	33.2433	5				x	x	x	x	x
SRNB	Santee River	North Bay	SC	cv	79.2487	33.1728	5				x	x	x	x	x
CHFJ	Charleston Harbor	Fort Johnson	SC	cv	79.8783	32.7553	8	x	x	x	x	x	x	x	x
CHSF	Charleston Harbor	Shutes Folly Island	SC	cv	79.9167	32.7805	7	x	x	x	x	x	x	x	
SRTI	Savannah River Estua	Tybee Island	GA	cv	80.8708	32.0200	8	x	x	x	x	x	x	x	x
SSSI	Sapelo Sound	Sapelo Island	GA	cv	81.2888	31.3867	7	x	x	x	x	x	x	x	
ARWI	Altamaha River	Wolfe Island	GA	cv	81.3080	31.3228	5				x	x	x	x	x
SJCB	St. Johns River	Chicopit Bay	FL	cv	81.4438	30.3770	8	x	x	x	x	x	x	x	x
MRCB	Matanzas River	Crescent Beach	FL	cv	81.2563	29.7667	7	x	x	x	x	x	x	x	
IRSR	Indian River	Sebastian River	FL	cv	80.4775	27.8348	6			x	x	x	x	x	x
NMML	North Miami	Maule Lake	FL	cv	80.1462	25.9355	5			x	x	x	x	x	
BBGC	Biscayne Bay	Goulds Canal	FL	cv	80.3142	25.5232	4					x	x	x	x
BBPC	Biscayne Bay	Princeton Canal	FL	cv	80.3292	25.5188	2	x	x						
BHKF	Bahia Honda	Key Florida	FL	cs	81.2738	24.6587	2						x	x	
PRBB	Puerto Rico	Bahia De Boqueron	PR	cr	67.1787	18.0073	2							x	x
PRBM	Puerto Rico	Bahia Montalva	PR	cr	66.9905	17.9705	2							x	x
PRBJ	Puerto Rico	Bahia De Jobos	PR	cr	66.1825	17.9388	2							x	x
EVFU	Everglades	Faka Union Bay	FL	cv	81.5130	25.9013	8	x	x	x	x	x	x	x	x
RBHC	Rookery Bay	Henderson Creek	FL	cv	81.7367	26.0250	8	x	x	x	x	x	x	x	x
NBNB	Naples Bay	Naples Bay	FL	cv	81.7858	26.1130	8	x	x	x	x	x	x	x	x
CBFM	Charlotte Harbor	Fort Meyers	FL	cv	81.9228	26.5583	6			x	x	x	x	x	x
CBBI	Charlotte Harbor	Bird Island	FL	cv	82.0363	26.5122	8	x	x	x	x	x	x	x	x
TBCB	Tampa Bay	Cockroach Bay	FL	cv	82.5093	27.6758	8	x	x	x	x	x	x	x	x
TBHB	Tampa Bay	Hillsborough Bay	FL	cv	82.3958	27.8547	4	x	x	x					x
TBKA	Tampa Bay	Peter O. Knight Airport	FL	cv	82.4548	27.9077	5				x	x	x	x	x
TBOT	Tampa Bay	Old Tampa Bay	FL	cv	82.6325	28.0247	5			x	x	x	x	x	x
TBPB	Tampa Bay	Papys Bayou	FL	cv	82.6103	27.8422	8	x	x	x	x	x	x	x	x
TBMK	Tampa Bay	Mullet Key Bayou	FL	cv	82.7270	27.6213	8	x	x	x	x	x	x	x	x
TBNP	Tampa Bay	Navarez Park	FL	cv	82.7547	27.7880	5				x	x	x	x	x
CKBP	Cedar Key	Black Point	FL	cv	83.0708	29.2053	8	x	x	x	x	x	x	x	x
SRWP	Suwannee River	West Pass	FL	cv	83.1742	29.3292	1			x					
AESP	Apalachee Bay	Spring Creek	FL	cv	84.3228	30.0625	5				x	x	x	x	x
APCP	Apalachicola Bay	Cat Point Bar	FL	cv	84.8842	29.7242	8	x	x	x	x	x	x	x	x
APDB	Apalachicola Bay	Dry Bar	FL	cv	85.0733	29.6742	8	x	x	x	x	x	x	x	x
SAWB	St. Andrews Bay	Watson Bayou	FL	cv	85.6320	30.1422	8	x	x	x	x	x	x	x	x
PCMP	Panama City	Municipal Pier	FL	cv	85.6633	30.1500	4			x	x	x			x
PCLO	Panama City	Little Oyster Bar	FL	cv	85.6825	30.2532	5				x	x	x	x	x
CBSR	Choctawhatchee Bay	Off Santa Rosa	FL	cv	86.2042	30.4130	8	x	x	x	x	x	x	x	x
CBBL	Choctawhatchee Bay	Bens Lake	Fl	cv	86.5408	30.4525	1							x	
CBPP	Choctawhatchee Bay	Postil Point	FL	cv	86.4788	30.4808	8	x	x	x	x	x	x	x	x
CBBB	Choctawhatchee Bay	Boggy Bayou	FL	cv	86.4942	30.5030	1							x	
CBJB	Choctawhatchee Bay	Joes Bayou	FL	cv	86.4908	30.4103	5				x	x	x	x	x
PBSP	Pensacola Bay	Sabine Point	FL	cv	87.1517	30.3467	2					x			x
PBIB	Pensacola Bay	Indian Bayou	FL	cv	87.1063	30.5225	7	x	x	x	x		x	x	x
PBPH	Pensacola Bay	Public Harbor	FL	cv	87.1903	30.4105	6			x	x	x	x	x	x
MBDR	Mobile Bay	Dog River	AL	cv	88.0453	30.5917	1					x			
MBHI	Mobile Bay	Hollingers Is. Chan.	AL	cv	88.0750	30.5633	6			x	x	x	x	x	x
MBCP	Mobile Bay	Cedar Point Reet	AL	cv	88.1333	30.3117	8	x	x	x	x	x	x	x	x
MSPB	Mississippi Sound	Pascagoula Bay	MS	cv	88.6017	30.3338	8	x	x	x	x	x	x	x	x
MSBB	Mississippi Sound	Biloxi Bay	MS	cv	88.8575	30.3925	7	x	x	x	x	x	x	x	x
MSPC	Mississippi Sound	Pass Christian	MS	cv	89.3267	30.2958	7	x	x	x	x	x	x	x	x
LPGO	Lake Pontchartrain	Gulf Outlet	LA	cv	89.0428	30.0407	1						x		
LBNO	Lake Borgne	New Orleans	LA	cv	89.8350	29.9433	1			x					
LBMP	Lake Borgne	Malheureux Point	LA	cv	89.6783	29.8670	8	x	x	x	x	x	x	x	x
BSBG	Breton Sound	Bay Gardene	LA	cv	89.6208	29.5983	8	x	x	x	x	x	x	x	x
BSSI	Breton Sound	Sable Island	LA	cv	89.4850	29.4018	8	x	x	x	x	x	x	x	x
MRPL	Mississippi River	Pass A Loutre	LA	cv	89.0922	29.0812	5			x	x	x	x	x	x
MRTP	Mississippi River	Tiger Pass	LA	cv	89.4278	29.1448	6			x	x	x			x
BBMB	Barataria Bay	Middle Bank	LA	cv	89.9422	29.2758	8	x	x	x	x	x	x	x	x
BBSD	Barataria Bay	Bayou Saint Denis	LA	cv	89.9958	29.4030	7	x	x	x	x	x		x	x
BBTB	Barataria Bay	Turtle Bay	LA	cv	90.0833	29.5112	2			x			x		
TBLF	Terrebonne Bay	Lake Felicity	LA	cv	90.4067	29.2633	8	x	x	x	x	x	x	x	x
TBLB	Terrebonne Bay	Lake Barre	LA	cv	90.5950	29.2600	8	x	x	x	x	x	x	x	x

Table 2 continued.

SITE	General Location	Specific Location	State	Sp.	Longitude W	Latitude N	ΣYrs	86	87	88	89	90	91	92	93
CLCL	Caillou Lake	Caillou Lake	LA	cv	90.9300	29.2542	8	x	x	x	x	x	x	x	x
ABOB	Atchafalaya Bay	Oyster Bayou	LA	cv	91.1350	29.2400	8	x	x	x	x	x	x	x	x
VBSP	Vermilion Bay	Southwest Pass	LA	cv	92.0458	29.5767	8	x	x	x	x	x	x	x	x
JHJH	Joseph Harbor Bayou	Joseph Harbor Bayou	LA	cv	92.7625	29.6292	8	x	x	x	x	x	x	x	x
CLSJ	Calcasieu Lake	St. Johns Island	LA	cv	93.3833	29.8305	8	x	x	x	x	x	x	x	x
CLLC	Calcasieu Lake	Lake Charles	LA	cv	93.2917	30.0583	6			x	x	x	x	x	x
SLBB	Sabine Lake	Blue Buck Point	TX	cv	93.9070	29.7917	8	x	x	x	x	x	x	x	x
GBHR	Galveston Bay	Hanna Reef	TX	cv	94.7333	29.4808	8	x	x	x	x	x	x	x	x
GBSC	Galveston Bay	Ship Channel	TX	cv	94.9930	29.7045	6			x	x	x	x	x	x
GBYC	Galveston Bay	Yacht Club	TX	cv	94.9917	29.6217	8	x	x	x	x	x	x	x	x
GBTD	Galveston Bay	Todds Dump	TX	cv	94.8970	29.5010	8	x	x	x	x	x	x	x	x
GBOB	Galveston Bay	Oflatts Bayou	TX	cv	94.8358	29.2847	6			x	x	x	x	x	x
GBCR	Galveston Bay	Confederate Reef	TX	cv	94.9147	29.2625	8	x	x	x	x	x	x	x	x
BRFS	Brazos River	Freeport Surfside	TX	cv	95.3388	28.9208	6			x	x	x	x	x	x
BRCL	Brazos River	Cedar Lakes	TX	cv	95.4638	28.8583	5				x	x	x	x	x
MBEM	Matagorda Bay	East Matagorda	TX	cv	95.8833	28.7112	8	x	x	x	x	x	x	x	x
MBDI	Matagorda Bay	Dog Island	TX	cv	96.0025	28.6380	1			x					
MBTP	Matagorda Bay	Tres Palacios Bay	TX	cv	96.2242	28.6583	8	x	x	x	x	x	x	x	x
MBCB	Matagorda Bay	Carancahua Bay	TX	cv	96.3863	28.6567	3			x		x			x
MBLR	Matagorda Bay	Lavaca River Mouth	TX	cv	96.5805	28.6633	8	x	x		x	x	x	x	x
MBGP	Matagorda Bay	Gallinipper Point	TX	cv	96.5695	28.5875	7	x	x	x	x		x	x	x
ESBD	Espiritu Santo	Bill Days Reef	TX	cv	96.4378	28.4142	5			x	x	x		x	x
ESSP	Espiritu Santo	South Pass Reef	TX	cv	96.6222	28.2983	6	x	x			x	x	x	
SAMP	San Antonio Bay	Mosquito Point	TX	cv	96.7130	28.3442	5	x	x		x		x	x	
SAPP	San Antonio Bay	Panther Point Reef	TX	cv	96.7092	28.2370	7	x	x			x	x	x	x
MBAR	Mesquite Bay	Ayres Reef	TX	cv	96.8325	28.1692	8	x	x	x	x	x	x	x	x
ABLR	Aransas Bay	Long Reef	TX	CV	96.9633	28.0647	8	x	x	x	x	x	x	x	x
CBCR	Copano Bay	Copano Reef	TX	cv	97.1278	28.1412	7	x	x	x	x	x	x	x	
ABHI	Aransas Bay	Harbor Island	TX	cv	97.0753	27.8388	1			x					
CCIC	Corpus Christi	Ingleside Cove	TX	cv	97.2380	27.8380	6	x		x	x	x	x	x	
CCNB	Corpus Christi	Nueces Bay	TX	cv	97.3592	27.8528	7	x	x	x	x	x		x	x
CCBH	Corpus Christi	Boat Harbor	TX	cv	97.3787	27.8362	2			x		x			
LMAC	Lower Laguna Madre	Arroyo Colorado	TX	cv	97.2883	26.2800	1					x		x	
LMPI	Lower Laguna Madre	Port Isabel	TX	cv	97.2008	26.0770	2			x				x	
LMSB	Lower Laguna Madre	South Bay	TX	cv	97.1747	26.0462	8	x	x	x	x	x	x	x	x
IBNJ	Imperial Beach	North Jetty	CA	mc	117.1325	32.5875	8	x	x	x	x	x	x	x	x
SDCB	San Diego Bay	Coronado Bridge	CA	me	117.1572	32.6812	5				x	x	x	x	x
PLLH	Point Loma	Lighthouse	CA	mc	117.2487	32.6812	7	x	x	x	x	x	x	x	
SDHI	San Diego Bay	Harbor Island	CA	me	117.1930	32.7247	8	x	x	x	x	x	x	x	x
MBVB	Mission Bay	Ventura Bridge	CA	me	117.2412	32.7678	8	x	x	x	x	x	x	x	x
LJLJ	La Jolla	Point La Jolla	CA	mc	117.3287	32.8125	7	x	x	x	x	x	x	x	
OSBJ	Oceanside	Beach Jetty	CA	me	117.3927	33.2018	8	x	x	x	x	x	x	x	x
SCBR	Santa Catalina Island	Bird Rock	CA	mc	118.4867	33.4517	6	x	x	x		x	x	x	
NBWJ	Newport Beach	Wedge Jetty	CA	mc	117.8795	33.5913	7	x	x	x	x	x	x	x	
ABWJ	Anaheim Bay	West Jetty	CA	mc	118.1302	33.7378	8	x	x	x	x	x	x	x	x
LBBW	Long Beach	Breakwater	CA	me	118.1742	33.7237	4					x	x	x	x
SPFP	San Pedro Harbor	Fishing Pier	CA	me	118.2767	33.7103	7	x	x	x	x	x	x	x	
PVRP	Palos Verdes	Royal Palms State Park	CA	mc	118.3225	33.7183	8	x	x	x	x	x	x	x	x
RBMJ	Redondo Beach	Municipal Jetty	CA	mc	118.4143	33.8235	4					x	x	x	x
MDSJ	Marina Del Rey	South Jetty	CA	me	118.4570	33.9613	8	x	x	x	x	x	x	x	x
TBSM	Las Tunas Beach	Santa Monica Bay	CA	mc	118.5622	34.0267	4					x	x	x	x
PDPD	Point Dume	Point Dume	CA	mc	118.8080	34.0013	8	x	x	x	x	x	x	x	x
SCFP	Santa Cruz Island	Fraser Point	CA	mc	119.9208	34.0598	6	x	x	x		x	x	x	
SANM	San Miguel Island	Tyler Bight	CA	mc	120.4193	34.0280	1			x					
SBSB	Point S. Barbara	Point Santa Barbara	CA	mc	119.7287	34.3958	8	x	x	x	x	x	x	x	x
PCPC	Point Conception	Point Conception	CA	mc	120.4333	34.4427	7	x	x	x	x	x	x	x	
SLSL	San Luis Obispo Bay	Point San Luis	CA	mc	120.7543	35.1607	8	x	x	x	x	x	x	x	x
SSSS	San Simeon Point	San Simeon Point	CA	mc	121.1950	35.6367	7	x	x	x	x	x	x	x	
PGLP	Pacific Grove	Lovers Point	CA	mc	121.9152	36.6258	8	x	x	x	x	x	x	x	x
MBML	Monterey Bay	Moss Landing	CA	mc	121.7892	36.8015	4					x	x	x	x
MBSC	Monterey Bay	Point Santa Cruz	CA	mc	122.0242	36.9533	8	x	x	x	x	x	x	x	x
FIEL	Farallon Islands	East Landing	CA	mc	122.9998	37.6962	1			x					
SFSM	San Francisco Bay	San Mateo Bridge	CA	me	122.2527	37.5818	7	x	x	x	x	x	x	x	
SFDB	San Francisco Bay	Dumbarton Bridge	CA	me	122.1605	37.5267	8	x	x	x	x	x	x	x	x
SFEM	San Francisco Bay	Emeryville	CA	me	122.3288	37.8203	7		x	x	x	x	x	x	x
TBSR	Tomales Bay	Spengers Residence	CA	me	122.9028	38.1492	7	x	x	x	x	x	x	x	
BBBE	Bodega Bay	Bodega Bay Entrance	CA	mc	123.0645	38.3050	8	x	x	x	x	x	x	x	x
PALH	Point Arena	Lighthouse	CA	mc	123.7383	38.9530	7	x	x	x	x	x	x	x	
PDSC	Point Delgada	Shelter Cove	CA	mc	124.0733	40.0225	8	x	x	x	x	x	x	x	x

Table 2 continued.

SITE	General Location	Specific Location	State	Sp.	Longitude W	Latitude N	ΣYrs	86	87	88	89	90	91	92	93
HMBJ	Eureka	Humboldt Bay Jetty	CA	mc	124.2138	40.7510	8	x	x	x	x	x	x	x	x
EUSB	Eureka	Samoa Bridge	CA	mc	124.1682	40.8220	3					x	x	x	
KRFR	Klamath River	Flint Rock Head	CA	mc	124.0797	41.5272	1				x				
SGSG	Crescent	Point St. George	CA	mc	124.2072	41.7480	8	x	x	x	x	x	x	x	x
CBCH	Coos Bay	Coos Head	OR	mc	124.3308	43.3505	8	x	x	x	x	x	x	x	x
CBRP	Coos Bay	Russell Point	OR	me	124.2172	43.4292	8	x	x	x	x	x	x	x	x
YBOP	Yaquina Bay	Oneatta Point	OR	me	124.0008	44.5830	8	x	x	x	x	x	x	x	x
YHSS	Yaquina Bay	Sallys Slough	OR	mc	124.0158	44.6138	1								x
YHYH	Yaquina Bay	Yaquina Head	OR	mc	124.0780	44.6763	6	x	x	x	x	x	x	x	
YHFC	Yaquina Bay	Foggerty Creek	OR	mc	124.0583	44.8400	2								x
TBHP	Tillamook Bay	Hobsonville Point	OR	me	123.9265	45.5160	8	x	x	x	x	x	x	x	x
CRSJ	Columbia River	South Jetty	OR	me	124.0463	46.2333	8	x	x	x	x	x	x	x	x
CRNJ	Columbia River	North Jetty	WA	me	124.0622	46.2778	2				x	x			
WBNA	Willapa Bay	Nahcotta	WA	me	124.0060	46.5080	4					x	x	x	x
GHWJ	Grays Harbor	Westport Jetty	WA	mc	124.1175	46.9125	8	x	x	x	x	x	x	x	x
JFCF	Juan de Fuca Strait	Cape Flattery	WA	mc	124.7213	48.3883	7	x	x	x		x	x	x	x
PSPA	Puget Sound	Port Angeles	WA	me	123.4168	48.1397	5				x	x	x	x	x
PSPT	Puget Sound	Port Townsend	WA	me	122.7650	48.1030	4					x	x	x	x
PSHC	Puget Sound	Hood Canal	WA	me	122.6867	47.8317	5				x	x	x	x	x
SSBI	South Puget Sound	Budd Inlet	WA	me	122.9122	47.1005	8	x	x	x	x	x	x	x	x
CBTP	Commencement Bay	Tahlequah Point	WA	me	122.5017	47.3358	8	x	x	x	x	x	x	x	x
PSSS	Puget Sound	South Seattle	WA	me	122.3987	47.5288	5				x	x	x	x	x
EBDH	Elliott Bay	Duwamish Head	WA	me	122.4180	47.5758	1					x			
EBFR	Elliott Bay	Four-Mile Rock	WA	me	122.4123	47.6392	8	x	x	x	x	x	x	x	x
SIWP	Sinclair Inlet	Waterman Point	WA	me	122.6270	47.5508	8	x	x	x	x	x	x	x	x
WIPP	Whidbey Island	Possession Point	WA	me	122.3800	47.9025	8	x	x	x	x	x	x	x	x
PSEH	Puget Sound	Everett Harbor	WA	me	122.2370	47.9738	2				x	x			
BBSM	Bellingham Bay	Squalicum Marina Jetty	WA	me	122.4995	48.7542	8	x	x	x	x	x	x	x	x
PRPR	Point Roberts	Point Roberts	WA	me	123.0217	48.9817	8	x	x	x	x	x	x	x	x
PVMC	Port Valdez	Mineral Creek Flats	AK	me	146.4625	61.1362	7	x	x	x		x	x	x	x
UISB	Unakwit Inlet	Siwash Bay	AK	me	147.6575	60.9558	7	x	x	x		x	x	x	x
HHKL	Honolulu Harbor	Keehi Lagoon	HI	os	157.8883	21.3025	6	x	x	x		x	x	x	
BPBP	Barbers Point	Barbers Point Harbor	HI	os	158.1242	21.3250	6	x	x	x		x	x	x	
KAUI	Kauai	Nawiliwili Harbor	HI	os	159.3558	21.9567	1			x					
GBBS	Green Bay	Bayshore Park	WI	dp	87.7967	44.6367	1								x
LMMB	Lake Michigan	Milwaukee Bay	WI	dp	87.8953	43.0333	1								x
LMNC	Lake Michigan	North Chicago	IL	dp	87.8278	42.3055	1								x
LMCB	Lake Michigan	Calumet Breakwater	IN	dp	87.4950	41.7272	1								x
LMHB	Lake Michigan	Holland Breakwater	MI	dp	86.2147	42.7738	1								x
LMMU	Lake Michigan	Muskegon Breakwater	MI	dp	86.3472	43.2270	1								x
SBSR	Saginaw Bay	Saginaw River	MI	dp	83.8570	43.6733	2							x	x
SBSP	Saginaw Bay	Sand Point	MI	dp	83.4983	43.9100	2							x	x
LHBR	Lake Huron	Black River Canal	MI	dp	82.4367	43.0422	1							x	
LSAB	Lake St. Clair	Anchor Bay	MI	dp	82.7187	42.6412	2							x	x
LESP	Lake Erie	Stony Point	MI	dp	83.2263	41.9577	2							x	x
LERB	Lake Erie	Reno Beach	OH	dp	83.2298	41.6750	2							x	x
SBPP	South Bass Island	Peach Orchard Point	OH	dp	82.8242	41.6607	2							x	x

Table 3. Site codes, names, states, species, number of years sampled since 1990, and number of years since 1990 in which the concentration of the specified chemical was "high."

SITE	General Location	Specific Location	State	Sp..	No.yrs	As	Cd	Cu	Hg	Ni	Se	Pb	Zn	ΣDDT	ΣCdane	ΣDield	ΣPCB	ΣPAH	ΣBt
PBPI	Penobscot Bay	Pickering Island	ME	me	4				1										
PBSI	Penobscot Bay	Sears Island	ME	me	4				4										1
MSSP	Merriconeag Snd.	Stover Point	ME	me	4														
CAKP	Cape Arundel	Kennebunkport	ME	me	4														
CAGH	Cape Ann	Gap Head	MA	me	4	4			1										
SHFP	Salem Harbor	Folger Point	MA	me	4							4						1	1
MBNB	Massachusetts Bay	Nahant Bay	MA	me	2				2			2							
BHDI	Boston Harbor	Deer Island	MA	me	4				3			3		1	1	1	2	4	
BHDB	Boston Harbor	Dorchester Bay	MA	me	2							2		2	2		2	2	
BHHB	Boston Harbor	Hingham Bay	MA	me	4				4	1		4			1	1	4		
BHBI	Boston Harbor	Brewster Island	MA	me	4				4			3					1	1	
MBNR	Massachusetts Bay	North River	MA	me	2				1			2							
DBCI	Duxbury Bay	Clarks Island	MA	me	4							1							
CCNH	Cape Cod	Nauset Harbor	MA	me	4														
BBNI	Buzzards Bay	Naushon Island	MA	me	3	2					1						1		
BBWF	Buzzards Bay	West Falmouth	MA	me	3	3											1		
BBCC	Buzzards Bay	Cape Cod Canal	MA	me	3	1													
BBAR	Buzzards Bay	Angelica Rock	MA	me	4	2					1						4	1	
BBRH	Buzzards Bay	Round Hill	MA	me	1												1		
BBGN	Buzzards Bay	Goosebury Neck	MA	me	4	2					2						2		
NBDI	Narragansett Bay	Dyer Island	RI	me	2	1				1	1	1		1					
NBPI	Narragansett Bay	Patience Island	RI	me	4			2				1			1	2			
NBDU	Narragansett Bay	Dutch Island	RI	me	3					1	1								
BIBI	Block Island Sound	Block Island	RI	me	4	2													
LICR	Long Island Sound	Connecticut River	CT	me	3														
LINH	Long Island Sound	New Haven	CT	me	4										1	1	3		
LIHR	Long Island Sound	Housatonic River	CT	me	3			1							1		2		
LISI	Long Island Sound	Sheffield Island	CT	me	2										1				
LIMR	Long Island Sound	Mamaroneck	NY	me	3			1				3		1	2	1	1	1	
LITN	Long Island Sound	Throgs Neck	NY	me	4							4		2	3	2	3	4	
LIHH	Long Island Sound	Hempstead Harbor	NY	me	4										3	3			
LIHU	Long Island Sound	Huntington Harbor	NY	me	3										1				
LIPJ	Long Island Sound	Port Jefferson	NY	me	4											1		1	1
LIGB	Long Island	Gardiners Bay	NY	me	4											1		1	
MBTH	Moriches Bay	Tuthill Point	NY	me	4				3		1								
LIFI	Long Island	Fire Island Inlet	NY	me	1				1		1								
LIJI	Long Island	Jones Inlet	NY	me	2				1										
HRJB	Hudson/Raritan Estu	Jamaica Bay	NY	me	4			3	3			4		1	2	3	3	4	
HRUB	Hudson/Raritan Est	Upper Bay	NY	me	3		2	3	3	3	1	3	3	3	2	2	3	3	2
HRLB	Hudson/Raritan Estu	Lower Bay	NY	me	2			2	1	1		2		2	1	1	2	2	1
HRRB	Hudson/Raritan Est	Raritan Bay	NJ	me	1					1				1	1	1	1	1	
NYSH	New York Bight	Sandy Hook	NJ	me	3			2	3	3	1	3	1	3	2	2	3	3	1
NYLB	New York Bight	Long Branch	NJ	me	2			1	1	1	1	1				1	2	1	
NYSR	New York Bight	Shark River	NJ	me	4				4			2			1		3	2	
BIBL	Barnegat Inlet	Barnegat Light	NJ	me	3				2										
AIAC	Absecon Inlet	Atlantic City	NJ	me	3				2										
DBCM	Delaware Bay	Cape May	NJ	me	4						4								
DBFE	Delaware Bay	False Egg Island Poi	NJ	cv	3					3				1		1			
DBBD	Delaware Bay	Ben Davis Point Sho	NJ	cv	2					2			1	2		1			1
DBAP	Delaware Bay	Arnolds Point Shoal	NJ	cv	3		3	3		3			3	3		1			
DBHC	Delaware Bay	Hope Creek	NJ	cv															
DBWB	Delaware Bay	Woodland Beach	DE	cv															
DBKI	Delaware Bay	Kelly Island	DE	cv	3					3				2					
DBCH	Delaware Bay	Cape Henlopen	DE	me	4						3								
CBBO	Chesapeake Bay	Bodkin Point	MD	cv	2		2	1		2	2		2		1	1			1
CBMP	Chesapeake Bay	Mountain Point Bar	MD	cv	4		4			4			2						1
CBHP	Chesapeake Bay	Hackett Point Bar	MD	cv	3						1								
CBCP	Chesapeake Bay	Choptank River	MD	cv	4					4									
CBHG	Chesapeake Bay	Hog Point	MD	cv	3					3									
PRSP	Potomac River	Swan Point	MD	cv	1					1									
PRMC	Potomac River	Mattox Creek	VA	cv	1					1									
PRRP	Potomac River	Ragged Point	VA	cv	4					4									
CBIB	Chesapeake Bay	Ingram Bay	VA	cv															
RRRR	Rappahannock River	Ross Rock	VA	cv	4		3			1									
CBDP	Chesapeake Bay	Dandy Point	VA	cv	4														1
CBJR	Chesapeake Bay	James River	VA	cv	1		1	1		1	1		1						1
CBCC	Chesapeake Bay	Cape Charles	VA	cv	3														
CBCI	Chincoteague Bay	Chincoteague Inlet	VA	cv	4														
QIUB	Quinby Inlet	Upshur Bay	VA	cv	3					1								1	

Table 3 continued.

SITE	General Location	Specific Location	State	Sp.	No. yr	As	Cd	Cu	Hg	Ni	Se	Pb	Zn	ΣDDT	ΣCdane	ΣDield	ΣPCB	ΣPAH	ΣBt
RSJC	Roanoke Sound	John Creek	NC	cv	3														
PSWB	Pamlico Sound	Wysocking Bay	NC	cv	4				1	1									
PSPR	Pamlico Sound	Pungo River	NC	cv	4														
PSNR	Pamlico Sound	Neuse River	NC	cv	4														
PSCH	Pamlico Sound	Cape Hatteras	NC	cv	4	2												1	
BIPI	Beaufort Inlet	Pivers Island	NC	cv	4	4												4	1
CFBI	Cape Fear	Battery Island	NC	cv	4	4													
WBLB	Winyah Bay	Lower Bay	SC	cv	4	4					1								
SRNB	Santee River	North Bay	SC	cv	4	3					2								
CHFJ	Charleston Harbor	Fort Johnson	SC	cv	4	4					1							2	
CHSF	Charleston Harbor	Shutes Folly Island	SC	cv	3	3					2							1	2
SRTI	Savannah River Estu	Tybee Island	GA	cv	4	4					1								
SSSI	Sapelo Sound	Sapelo Island	GA	cv	3	3													
ARWI	Altamaha River	Wolfe Island	GA	cv	4	3					1								
SJCB	St. Johns River	Chicopit Bay	FL	cv	4	3					2								2
MRCB	Matanzas River	Crescent Beach	FL	cv	3	2													
IRSR	Indian River	Sebastian River	FL	cv	4					1									1
NMML	North Miami	Maule Lake	FL	cv	3			3	1						1				3
BBGC	Biscayne Bay	Goulds Canal	FL	cv	4	1												1	2
BBPC	Biscayne Bay	Princeton Canal	FL	cv															
BHKF	Bahia Honde	Key Florida	FL	cs	2	2				2									
PRBB	Puerto Rico	Bahia De Boqueron	PR	cr	2														
PRBM	Puerto Rico	Bahia Montalva	PR	cr	2						1								
PRBJ	Puerto Rico	Bahia De Jobos	PR	cr	2	1													
EVFU	Everglades	Faka Union Bay	FL	cv	4														
RBHC	Rookery Bay	Henderson Creek	FL	cv	4				1										
NBNB	Naples Bay	Naples Bay	FL	cv	4			2											3
CBFM	Charlotte Harbor	Fort Meyers	FL	cv	4										1				1
CBBI	Charlotte Harbor	Bird Island	FL	cv	4	2			1										
TBCB	Tampa Bay	Cockroach Bay	FL	cv	4				1						2				
TBHB	Tampa Bay	Hillsborough Bay	FL	cv	1														1
TBKA	Tampa Bay	Peter O. Knight Airp	FL	cv	4						1		2	2	4		2		4
TBOT	Tampa Bay	Old Tampa Bay	FL	cv	3				3				3						
TBPB	Tampa Bay	Papys Bayou	FL	cv	4		1		4										
TBMK	Tampa Bay	Mullet Key Bayou	FL	cv	4														
TBNP	Tampa Bay	Navarez Park	FL	cv	4	4									4			1	
CKBP	Cedar Key	Black Point	FL	cv	4	2													
SRWP	Suwannee River	West Pass	FL	cv															
AESP	Apalachee Bay	Spring Creek	FL	cv	4	1					1								
APCP	Apalachicola Bay	Cat Point Bar	FL	cv	4														
APDB	Apalachicola Bay	Dry Bar	FL	cv	4														
SAWB	St. Andrews Bay	Watson Bayou	FL	cv	4	1								1	1		2	4	
PCMP	Panama City	Municipal Pier	FL	cv	2	1												2	2
PCLO	Panama City	Little Oyster Bar	FL	cv	4									2					
CBSR	Choctawhatchee Ba	Off Santa Rosa	FL	cv	4				1		1								
CBBL	Choctawhatchee Ba	Bens Lake	Fl	cv	1				1		1			1		1			
CBPP	Choctawhatchee Ba	Postil Point	FL	cv	4				4		2	4		3	1				
CBBB	Choctawhatchee Ba	Boggy Bayou	FL	cv	1						1			1					
CBJB	Choctawhatchee Ba	Joes Bayou	FL	cv	4		1	1	4		2					2		4	2
PBSP	Pensacola Bay	Sabine Point	FL	cv	2														
PBIB	Pensacola Bay	Indian Bayou	FL	cv	3												2		
PBPH	Pensacola Bay	Public Harbor	FL	cv	4						1					1		1	
MBDR	Mobile Bay	Dog River	AL	cv	1		1	1					1	1	1		1	1	
MBHI	Mobile Bay	Hollingers Is. Chan.	AL	cv	4		2						3	4	1				
MBCP	Mobile Bay	Cedar Point Reef	AL	cv	4									1					
MSPB	Mississippi Sound	Pascagoula Bay	MS	cv	4	1					1								
MSBB	Mississippi Sound	Biloxi Bay	MS	cv	3		1				1				2			2	
MSPC	Mississippi Sound	Pass Christian	MS	cv	3		3												
LPGO	Lake Pontchartrain	Gulf Outlet	LA	cv	1		1	1		1	1		1	1	1	1	1	1	1
LBNO	Lake Borgne	New Orleans	LA	cv															
LBMP	Lake Borgne	Malheureux Point	LA	cv	4		4	1	2	2	2		1						
BSBG	Breton Sound	Bay Gardene	LA	cv	4						1								
BSSI	Breton Sound	Sable Island	LA	cv	4		4			3	1					2			
MRPL	Mississippi River	Pass A Loutre	LA	cv	3		3			2				1	1		1		
MRTP	Mississippi River	Tiger Pass	LA	cv	4		3							1		3			
BBMB	Barataria Bay	Middle Bank	LA	cv	4													3	4
BBSD	Barataria Bay	Bayou Saint Denis	LA	cv	3														
BBTB	Barataria Bay	Turtle Bay	LA	cv															
TBLF	Terrebonne Bay	Lake Felicity	LA	cv	4													1	
TBLB	Terrebonne Bay	Lake Barre	LA	cv	4														

Table 3 continued.

SITE	Generel Location	Specific Location	State	Sp.	No. yr	As	Cd	Cu	Hg	Ni	Se	Pb	Zn	ΣDDT	ΣCdane	ΣDield	ΣPCB	ΣPAH	ΣBt
CLCL	Caillou Lake	Caillou Lake	LA	cv	4					1									
ABOB	Atchafalaya Bay	Oyster Bayou	LA	cv	4		3				1								
VBSP	Vermilion Bay	Southwest Pass	LA	cv	4		4	1			2				1				
JHJH	Joseph Harbor Bayo	Joseph Harbor Bayo	LA	cv	4						3								
CLSJ	Calcasieu Lake	St. Johns Island	LA	cv	4		1			1	1							1	
CLLC	Calcasieu Lake	Lake Charles	LA	cv	4					1								1	
SLBB	Sabine Lake	Blue Buck Point	TX	cv	4					1	1								
GBHR	Galveston Bay	Hanna Reef	TX	cv	4		2				3								
GBSC	Galveston Bay	Ship Channel	TX	cv	4		3			2	4		1	1	4	4	4		3
GBYC	Galveston Bay	Yacht Club	TX	cv	4										2	2			4
GBTD	Galveston Bay	Todds Dump	TX	cv	4														1
GBOB	Galveston Bay	Offatts Bayou	TX	cv	4										4	1			
GBCR	Gelveston Bay	Confederate Reef	TX	cv	4						2								
BRFS	Brazos River	Freeport Surfside	TX	cv	4			1		1	2			3				2	1
BRCL	Brazos River	Cedar Lakes	TX	cv	4					1	1			1				1	
MBEM	Matagorda Bay	East Matagorda	TX	cv	4		3			1	2								
MBDI	Matagorda Bay	Dog Island	TX	cv															
MBTP	Matagorda Bay	Tres Palacios Bay	TX	cv	4		1			1	3								
MBCB	Matagorda Bay	Carancahua Bay	TX	cv	2		1												
MBLR	Matagorda Bay	Lavaca River Mouth	TX	cv	4		1		4	2	3								
MBGP	Matagorda Bay	Gallinipper Point	TX	cv	3				3	1	1								
ESBD	Espiritu Santo	Bill Days Reef	TX	cv	3														
ESSP	Espiritu Santo	South Pass Reef	TX	cv	3		1				1								
SAMP	San Antonio Bay	Mosquito Point	TX	cv	2						1								
SAPP	San Antonio Bay	Panther Point Reef	TX	cv	4		1				3								
MBAR	Mesquite Bay	Ayres Reef	TX	cv	4		2				1								
ABLR	Aransas Bay	Long Reef	TX	cv	4		1												
CBCR	Copano Bay	Copano Reef	TX	cv	3		2				1								
ABHI	Aransas Bay	Harbor Island	TX	cv															
CCIC	Corpus Christi	Ingleside Cove	TX	cv	3														2
CCNB	Corpus Christi	Nueces Bay	TX	cv	3						1								
CCBH	Corpus Christi	Boat Harbor	TX	cv	1		1				1							1	
LMAC	Lower Laguna Madre	Arroyo Colorado	TX	cv	1														
LMPI	Lower Laguna Madre	Port Isabel	TX	cv															
LMSB	Lower Laguna Madre	South Bay	TX	cv	4				1										
IBNJ	Imperial Beach	North Jetty	CA	mc	4									4		1			
SDCB	San Diego Bay	Coronado Bridge	CA	me	4		3	4	2	1		1	3			1	3	4	2
PLLH	Point Loma	Lighthouse	CA	mc	3	3		2	3	1			2						
SDHI	San Diego Bay	Harbor Island	CA	me	4			2					3	1	2	1	4	4	3
MBVB	Mission Bay	Ventura Bridge	CA	me	4														
LJLJ	La Jolla	Point La Jolla	CA	mc	3	3			1										
OSBJ	Oceanside	Beach Jetty	CA	me	4								1	1	1	1			
SCBR	Santa Catalina Islanc	Bird Rock	CA	mc	3	1								1					
NBWJ	Newport Beach	Wedge Jetty	CA	mc	3							2		2					
ABWJ	Anaheim Bay	West Jetty	CA	mc	4							2		4	4	1	1		
LBBW	Long Beach	Breakwater	CA	me	4							3	1	4		2			1
SPFP	San Pedro Harbor	Fishing Pier	CA	me	3			2			1		1	3			2	3	3
PVRP	Palos Verdes	Royal Palms State P	CA	mc	4	4			2		1		3	4					
RBMJ	Redondo Beach	Municipal Jetty	CA	mc	4	1					3			4					
MDSJ	Marina Del Rey	South Jetty	CA	me	4						3	4	2	4	4			2	
TBSM	Las Tunas Beach	Santa Monica Bay	CA	mc	4		1	1	2		2	3	2	2					
PDPD	Point Dume	Point Dume	CA	mc	4									2					
SCFP	Santa Cruz Island	Fraser Point	CA	mc	3	3	1												
SANM	San Miguel Island	Tyler Bight	CA	mc															
SBSB	Point S. Barbara	Point Santa Barbara	CA	mc	4					1									
PCPC	Point Conception	Point Conception	CA	mc	3														
SLSL	San Luis Obispo Bay	Point San Luis	CA	mc	4													1	
SSSS	San Simeon Point	San Simeon Point	CA	mc	3		2		2	3									
PGLP	Pacific Grove	Lovers Point	CA	mc	4	1	3					4	3						
MBML	Monterey Bay	Moss Landing	CA	mc	4					3		2		3	1	2			
MBSC	Monterey Bay	Point Santa Cruz	CA	mc	4							1	1	1		3			
FIEL	Farallon Islands	East Landing	CA	mc															
SFSM	San Francisco Bay	San Mateo Bridge	CA	me	3		2		2	1	3			1	1	2	3	1	
SFDB	San Francisco Bay	Dumbarton Bridge	CA	me	4		3		3	4	4			2	1	4	4	2	
SFEM	San Francisco Bay	Emeryville	CA	me	4		4		4	3	2	1	3	2	1	2	4	4	2
TBSR	Tomales Bay	Spengers Residence	CA	me	3					1									
BBBE	Bodega Bay	Bodega Bay Entranc	CA	mc	4		4												
PALH	Point Arena	Lighthouse	CA	mc	3		3		1	3									
PDSC	Point Delgada	Shelter Cove	CA	mc	4	1	3		2	1									

Table 3 continued.

SITE	General Location	Specific Location	State	Sp.	No. yr	As	Cd	Cu	Hg	Ni	Se	Pb	Zn	ΣDDT	ΣCdane	ΣDield	ΣPCB	ΣPAH	ΣBt
HMBJ	Eureka	Humboldt Bay Jetty	CA	mc	4					1									
EUSB	Eureka	Samoa Bridge	CA	mc	3			1		1									
KRFR	Klamath River	Flint Rock Head	CA	mc															
SGSG	Crescent	Point St. George	CA	mc	4	3	2			4									
CBCH	Coos Bay	Coos Head	OR	mc	4					1									
CBRP	Coos Bay	Russell Point	OR	me	4					1			2						1
YBOP	Yaquina Bay	Oneatta Point	OR	me	4														
YHSS	Yaquina Bay	Sallys Slough	OR	mc	1														
YHYH	Yaquina Bay	Yaquina Head	OR	mc	2		1												
YHFC	Yaquina Bay	Foggerty Creek	OR	mc	2														
TBHP	Tillamook Bay	Hobsonville Point	OR	me	4					1									
CRSJ	Columbia River	South Jetty	OR	me	4														
CRNJ	Columbia River	North Jetty	WA	me	1														
WBNA	Willapa Bay	Nahcotta	WA	me	4					2	4		1					1	
GHWJ	Grays Harbor	Westport Jetty	WA	mc	4						2	1							
JFCF	Juan de Fuca Strait	Cape Flattery	WA	mc	4		2				1								
PSPA	Puget Sound	Port Angeles	WA	me	4														
PSPT	Puget Sound	Port Townsend	WA	me	4												1	4	
PSHC	Puget Sound	Hood Canal	WA	me	4													1	
SSBI	South Puget Sound	Budd Inlet	WA	me	4													1	
CBTP	Commencement Bay	Tahlequah Point	WA	me	4					1			1					4	
PSSS	Puget Sound	South Seattle	WA	me	4													4	
EBDH	Elliott Bay	Duwamish Head	WA	me	1													1	
EBFR	Elliott Bay	Four-Mile Rock	WA	me	4								2					4	
SIWP	Sinclair Inlet	Waterman Point	WA	me	4								1						
WIPP	Whidbey Island	Possession Point	WA	me	4					3									
PSEH	Puget Sound	Everett Harbor	WA	me	1													1	
BBSM	Bellingham Bay	Squalicum Marina J	WA	me	4			1		2			3					3	
PRPR	Point Roberts	Point Roberts	WA	me	4					3			1						
PVMC	Port Valdez	Mineral Creek Flats	AK	me	4			1			2								
UISB	Unakwit Inlet	Siwash Bay	AK	me	4						3								
HHKL	Honolulu Harbor	Keehi Lagoon	HI	os	3	2		3	2	1		3			2	2		3	3
BPBP	Barbers Point	Barbers Point Harbo	HI	os	3	2		3		2									3
KAUI	Kauai	Nawiliwili Harbor	HI	os															
GBBS	Green Bay	Bayshore Park	WI	dp	1					1				1			1		
LMMB	Lake Michigan	Milwaukee Bay	WI	dp	1			1		1	1		1	1	1	1	1	1	
LMNC	Lake Michigan	North Chicago	IL	dp	1		1	1		1	1	1		1			1		
LMCB	Lake Michigan	Calumet Breakwater	IN	dp	1		1	1		1	1								
LMHB	Lake Michigan	Holland Breakwater	MI	dp	1					1	1			1	1	1	1		
LMMU	Lake Michigan	Muskegon Breakwat	MI	dp	1			1		1	1			1	1	1	1		
SBSR	Saginaw Bay	Saginaw River	MI	dp	2		1	2		2	2			1			2	1	
SBSP	Saginaw Bay	Sand Point	MI	dp	2			1		1	1								
LHBR	Lake Huron	Black River Canal	MI	dp	1		1	1		1	1								
LSAB	Lake St. Clair	Anchor Bay	MI	dp	2			2		2	2								
LESP	Lake Erie	Stony Point	MI	dp	2		2	2		2	2	1				1	2	1	
LERB	Lake Erie	Reno Beach	OH	dp	2		2	2		2	2					1			
SBPP	South Bass Island	Peach Orchard Point	OH	dp	2		2	2		2	2	1		1			1		

Table 4. Site codes, names, states, number of years sampled since 1990, and number of years when lead concentration exceeded the FDA guideline.

				No yrs	No yrs	No yrs	No yrs	No yrs	No yrs	No yrs
SITE	General Location	Specific Location	St	since 90	Pb>4 ppm	Pb>7 ppm	Pb>7.5 p	Pb>10.5	Pb>21ppi	Pb>31.5
SHFP	Salem Harbor	Folger Point	MA	4	4	4	4	4	none	
MBNB	Massachusetts Bay	Nahant Bay	MA	2	2	none				
BHDI	Boston Harbor	Deer Island	MA	4	3	1	1	none		
BHDB	Boston Harbor	Dorchester Bay	MA	2	2	2	2	2	none	
BHHB	Boston Harbor	Hingham Bay	MA	4	4	4	4	2	none	
BHBI	Boston Harbor	Brewster Island	MA	4	3	2	2	1	none	
MBNR	Massachusetts Bay	North River	MA	2	2	1	1	none		
DBCI	Duxbury Bay	Clarks Island	MA	4	1	none				
NBDI	Narragansett Bay	Dyer Island	RI	2	1	none				
NBPI	Narragansett Bay	Patience Island	RI	4	1	none				
LIMR	Long Island Sound	Mamaroneck	NY	3	3	none				
LITN	Long Island Sound	Throgs Neck	NY	4	4	1	1	none		
HRJB	Hudson/Raritan Estua	Jamaica Bay	NY	4	4	1	1	none		
HRUB	Hudson/Raritan Estua	Upper Bay	NY	3	3	3	3	3	2	none
HRLB	Hudson/Raritan Estua	Lower Bay	NY	2	2	none				
NYSH	New York Bight	Sandy Hook	NJ	3	3	2	2	none		
NYLB	New York Bight	Long Branch	NJ	2	1	none				
NYSR	New York Bight	Shark River	NJ	4	2	none				
CBPP	Choctawhatchee Bay	Postil Point	FL	4	4	3	3	1	none	
SDCB	San Diego Bay	Coronado Bridge	CA	4	1	none				
NBWJ	Newport Beach	Wedge Jetty	CA	3	2	none				
ABWJ	Anaheim Bay	West Jetty	CA	4	2	1	1	none		
LBBW	Long Beach	Breakwater	CA	4	3	none				
RBMJ	Redondo Beach	Municipal Jetty	CA	4	1	none				
MDSJ	Marina Del Rey	South Jetty	CA	4	4	2	2	none		
TBSM	Las Tunas Beach	Santa Monica Bay	CA	4	3	1	none			
PGLP	Pacific Grove	Lovers Point	CA	4	4	2	3	1	none	
MBML	Monterey Bay	Moss Landing	CA	4	2	none				
MBSC	Monterey Bay	Point Santa Cruz	CA	4	1	none				
SFEM	San Francisco Bay	Emeryville	CA	4	1	none				
GHWJ	Grays Harbor	Westport Jetty	WA	4	1	1	1	none		
HHKL	Honolulu Harbor	Keehi Lagoon	HI	3	3	2	2	1	1	1
LMNC	Lake Michigan	North Chicago	IL	1	1	none				
LESP	Lake Erie	Stony Point	MI	2	1	none				
SBPP	South Bass Island	Peach Orchard	OH	2	1	none				

Table 5. Site-by-site per chemical listing of increasing (I) and decreasing (D) trends in annually measured concentrations. Two asterisks (**) denote statistical confidence at the 95% level, while one asterisk (*) denotes 90% confidence.

SITE	Genaral Location	Spacific Location	St.	ΣYr	Sp.	As	Cd	Cu	Hg	Ni	Pb	Se	Zn	tCdar	tDDT	tDielc	tPCB	tPAH	tBT
PBPI	Penobscot Bay	Pickering Island	ME	8	me														
PBSI	Panobscot Bay	Sears Island	ME	8	me			D**	I*					D*		D*	D**		
MSSP	Marriconeag Snd.	Stover Point	ME	6	me														
CAGH	Cape Ann	Gap Head	MA	7	me									D*			D**		
SHFP	Salem Harbor	Folger Point	MA	6	me														
BHDI	Boston Harbor	Deer Island	MA	8	me			D**										D*	D**
BHDB	Boston Harbor	Dorchester Bay	MA	6	me														
BHHB	Boston Harbor	Hingham Bay	MA	8	me									D*					
BHBI	Boston Harbor	Brewster Island	MA	8	me			D**						D**		D*			
BBAR	Buzzards Bay	Angelica Rock	MA	8	me					D*	D*			D*					D*
BBGN	Buzzards Bay	Goosebury Neck	MA	8	me			D*								D**			
NBDI	Narragansett Bay	Dyer Island	RI	6	me			D**			D**								
NBDU	Narragansett Bay	Dutch Island	RI	6	ma													I*	D*
BIBI	Block Island Sound	Block Island	RI	7	me	I**		D**						D**			D**		D*
LICR	Long Island Sound	Connecticut Rivar	CT	7	me					D*									D*
LINH	Long Island Sound	New Haven	CT	8	me												D**		D*
LIHR	Long Island Sound	Housatonic River	CT	7	me					D*									
LISI	Long Island Sound	Sheffield Island	CT	6	me		D**												
LIMR	Long Island Sound	Mamaroneck	NY	7	me	D**	D**					D*		D*	D*			D*	D*
LITN	Long Island Sound	Throgs Neck	NY	8	me			D**					D**				D*		
LIHH	Long Island Sound	Hempstead Harbor	NY	8	me	D*	D**	D**		D**	D**		D**	D**	D**		D**		
LIHU	Long Island Sound	Huntington Harbor	NY	7	me		D*	D*						D**		D*	D**		
LIPJ	Long Island Sound	Port Jefferson	NY	8	me			D**									D**		D*
MBTH	Moriches Bay	Tuthill Point	NY	8	me		D*			I**	I*			D**	D**		D*	I**	
HRJB	Hudson/Raritan Est	Jamaica Bay	NY	8	me	I*	D**								D**				
HRUB	Hudson/Raritan Est	Upper Bay	NY	7	me	I*	D**	I**					I*						
HRLB	Hudson/Raritan Est	Lower Bay	NY	6	me														
NYSH	New York Bight	Sandy Hook	NJ	7	me	I*	D*												
NYLB	New York Bight	Long Branch	NJ	6	me		D*												
NYSR	New York Bight	Shark River	NJ	8	me	I*	D**	D**	I*					D**	D**				
DBFE	Dalaware Bay	Falsa Egg Island Po	NJ	6	cv														
DBBD	Dalaware Bay	Ben Davis Point Sh	NJ	6	cv					I*							D*		
DBAP	Delawara Bay	Arnolds Point Shoa	NJ	6	cv									D*			D**		
DBKI	Dalaware Bay	Kelly Island	DE	7	cv		D*					D**							
CBMP	Chesapeake Bay	Mountain Point Bar	MD	8	cv	D**						D**		D**	D**	D**	D**		D*
CBHP	Chesapeake Bay	Hackett Point Bar	MD	7	cv									D**	D**		D**		
CBHG	Chesapeake Bay	Hog Point	MD	7	cv									D**	D**	D**	D**		
CBDP	Chesapeake Bay	Dandy Point	VA	8	cv														
CBCC	Chesapeake Bay	Cape Charles	VA	7	cv	D*	D**							D**		D**			
CBCI	Chincoteague Bay	Chincoteagua Inlat	VA	8	cv									D*		D**		D**	
QIUB	Quinby Inlet	Upshur Bay	VA	7	cv	I**					I**			D**			D*	I*	
RSJC	Roanoke Sound	John Creek	NC	7	cv		D*											D*	
PSWB	Pamlico Sound	Wysocking Bay	NC	8	cv									D*			D*		
CFBI	Cape Fear	Battery Island	NC	8	cv														
CHFJ	Charlaston Harbor	Fort Johnson	SC	8	cv									D**			D*		
CHSF	Charlaston Harbor	Shutes Folly Island	SC	7	cv									D*			D**		
SRTI	Savannah River Estu	Tybee Island	GA	8	cv				I*					D**		D*			
SSSI	Sapelo Sound	Sapelo Island	GA	7	cv										D*	D*	D*	I**	

Table 5 continued.

SITE	General Location	Specific Location	St.	ΣYr	Sp.	As	Cd	Cu	Hg	Ni	Pb	Se	Zn	tCdar	tDDT	tDielc	tPCB	tPAH	tBT
SJCB	St. Johns River	Chicopit Bay	FL	8	cv	I•					D••			D••	D••		D••		
MRCB	Matanzas River	Crescent Beach	FL	7	cv											D••	D••		D•
IRSR	Indian River	Sebastian River	FL	6	cv												I•		
EVFU	Everglades	Faka Union Bay	FL	8	cv	D••						D•							
RBHC	Rookery Bay	Henderson Creek	FL	8	cv	D••													D••
NBNB	Naples Bay	Naples Bay	FL	8	cv	D••		I••					I••	D••			D••		D•
CBFM	Charlotte Harbor	Fort Meyers	FL	6	cv	D••				I••					D••				
CBBI	Charlotte Harbor	Bird Island	FL	8	cv		D••		D••					D••	D••		D••		
TBCB	Tampa Bay	Cockroach Bay	FL	8	cv						I••								D•
TBPB	Tampa Bay	Papys Bayou	FL	8	cv	D••				D••				D••	D•		D•		
TBMK	Tampa Bay	Mullet Key Bayou	FL	8	cv	D••								D••					
CKBP	Cedar Key	Black Point	FL	8	cv									D••	D•				
APCP	Apalachicola Bay	Cat Point Bar	FL	8	cv			I••						D••	D••	D••	D•		
APDB	Apalachicola Bay	Dry Bar	FL	8	cv										D••		D•	D••	
SAWB	St. Andrews Bay	Watson Bayou	FL	8	cv		D••							D••					D••
CBSR	Choctawhatchee Ba	Off Santa Rosa	FL	8	cv		D•		D•					D••	D••				
CBPP	Choctawhatchee Ba	Postil Point	FL	8	cv						I••			D••			D•		
PBIB	Pensacola Bay	Indian Bayou	Fl	7	cv									D••	D••				
PBPH	Pensacola Bay	Public Harbor	FL	6	cv														
MBHI	Mobile Bay	Hollingers Is. Chan.	AL	6	cv			I••	I••				I••	D•	D•				
MBCP	Mobile Bay	Cedar Point Reef	AL	8	cv	D•											D•		
MSPB	Mississippi Sound	Pascagoula Bay	MS	8	cv				D••										
MSBB	Mississippi Sound	Biloxi Bay	MS	7	cv	D••	I••						I••	D••	D••		D••		
MSPC	Mississippi Sound	Pass Christian	MS	7	cv									D••					
LBMP	Lake Borgne	Malheureux Point	LA	8	cv		I••		I••				I•	D•					
BSBG	Breton Sound	Bay Gardene	LA	8	cv			I•	I•				I••	D••		D••	D••		
BSSI	Breton Sound	Sable Island	LA	8	cv	D•													
MRTP	Mississippi River	Tiger Pass	LA	6	cv		I••					D••							
BBMB	Barataria Bay	Middle Bank	LA	8	cv									D••			D•		
BBSD	Barataria Bay	Bayou Saint Denis	LA	7	cv	D••					I••			D•					
TBLF	Terrebonne Bay	Lake Felicity	LA	8	cv			I••						D••		D••			
TBLB	Terrebonne Bay	Lake Barre	LA	8	cv									D•		D••			
CLCL	Caillou Lake	Caillou Lake	LA	8	cv						I••			D•					
ABOB	Atchafalaya Bay	Oyster Bayou	LA	8	cv									D••	D••	D••	D••		
VBSP	Vermilion Bay	Southwest Pass	LA	8	cv									D•					D•
JHJH	Joseph Harbor Bayc	Joseph Harbor Bay	LA	8	cv									D••					
CLSJ	Calcasieu Lake	St. Johns Island	LA	8	cv									D••	D••	D••	D••		
CLLC	Calcasieu Lake	Lake Charles	LA	6	cv														I•
SLBB	Sabine Lake	Blue Buck Point	TX	8	cv	I•			D••				D•	D•		D•			
GBHR	Galveston Bay	Hanna Reef	TX	8	cv					I•	I•			D•		D••			
GBSC	Galveston Bay	Ship Channel	TX	6	cv														
GBYC	Galveston Bay	Yacht Club	TX	8	cv								D••	D•	D••	D••	D••		
GBTD	Galveston Bay	Todds Dump	TX	8	cv									D•					
GBOB	Galveston Bay	Offatts Bayou	TX	6	cv														
GBCR	Galveston Bay	Confederate Reef	TX	8	cv				I••					D••		D••	D•		

Table 5 continued.

SITE	General Location	Specific Location	St.	ΣYr	Sp.	As	Cd	Cu	Hg	Ni	Pb	Se	Zn	tCdan	tDDT	tDield	tPCB	tPAH	tBT
BRFS	Brazos River	Freeport Surfside	TX	6	cv														
MBEM	Matagorda Bay	East Matagorda	TX	8	cv									D••	D••	D••			
MBTP	Matagorda Bay	Tres Palacios Bay	TX	8	cv									D••		D••	D••		
MBLR	Matagorda Bay	Lavaca River Mouth	TX	8	cv						I••	I••			D••			D••	D•
MBGP	Matagorda Bay	Gallinipper Point	TX	7	cv									D•		D•			I•
ESSP	Espiritu Santo	South Pass Reef	TX	6	cv							D••						D•	
SAPP	San Antonio Bay	Panther Point Reef	TX	7	cv		D•						D•	D••					
MBAR	Mesquite Bay	Ayres Reef	TX	8	cv	I••					I••				D•	D•			
ABLR	Aransas Bay	Long Reef	TX	8	cv		D••	D••					D•	D•					
CBCR	Copano Bay	Copano Reef	TX	7	cv										D••				D•
CCIC	Corpus Christi	Ingleside Cove	TX	6	cv									D••					I•
CCNB	Corpus Christi	Nueces Bay	TX	7	cv	D•	D••	D•			I•			D••					
LMSB	Lower Laguna Madr	South Bay	TX	8	cv	D••	D••			D••			D•				D•		D••
IBNJ	Imperial Beach	North Jetty	CA	8	mc				D•			D••		D••			D•	I•	
PLLH	Point Loma	Lighthouse	CA	7	mc				I••	I••					D•		D••		
SDHI	San Diego Bay	Harbor Island	CA	8	me		D••			D•	D•		D••						D•
MBVB	Mission Bay	Ventura Bridge	CA	8	me		D••		D••		D••			D••	D••				D••
LJLJ	La Jolla	Point La Jolla	CA	7	mc		D••	I•			D•	D••							
OSBJ	Oceanside	Beach Jetty	CA	8	me	I••	D••	I•											D••
SCBR	Santa Catalina Islan	Bird Rock	CA	6	mc							D••							
NBWJ	Newport Beach	Wedge Jetty	CA	7	mc			I•				D•							D•
ABWJ	Anaheim Bay	West Jetty	CA	8	mc		D••		D•		D••		D••	D•		D•			D••
SPFP	San Pedro Harbor	Fishing Pier	CA	7	me						D•			D••					
PVRP	Palos Verdes	Royal Palms State	CA	8	mc								I••	D•					D••
MDSJ	Marina Del Rey	South Jetty	CA	8	me				D••		D•								
PDPD	Point Dume	Point Dume	CA	8	mc	D••		D•		D••		D••					D••		D•
SCFP	Santa Cruz Island	Fraser Point	CA	6	mc													I•	
SBSB	Point S. Barbara	Point Santa Barbara	CA	8	mc	D•							I••						
PCPC	Point Conception	Point Conception	CA	7	mc	D•	I•									D•	D•		
SLSL	San Luis Obispo Bay	Point San Luis	CA	8	mc					D••				D•					D•
SSSS	San Simeon Point	San Simeon Point	CA	7	mc												D•		
PGLP	Pacific Grove	Lovers Point	CA	8	mc		I•							D•				I•	D•
MBSC	Monterey Bay	Point Santa Cruz	CA	8	mc														
SFSM	San Francisco Bay	San Mateo Bridge	CA	7	me									D•					D•
SFDB	San Francisco Bay	Dumbarton Bridge	CA	8	me								I•						D••
SFEM	San Francisco Bay	Emeryville	CA	7	me		I•		I••						D•		D•		D••
TBSR	Tomales Bay	Spengers Residenc	CA	7	me														
BBBE	Bodega Bay	Bodega Bay Entran	CA	8	mc							D••							
PALH	Point Arena	Lighthouse	CA	7	mc				I••			D••				D•		I•	
PDSC	Point Delgada	Shelter Cove	CA	8	mc							D••							
HMBJ	Eureka	Humboldt Bay Jett	CA	8	me														D•
SGSG	Crescent	Point St. George	CA	8	mc	I•			I••										
CBCH	Coos Bay	Coos Head	OR	8	mc		D••	D••			D••				I•	D••			D•

Table 5 continued.

SITE	General Location	Specific Location	St.	ΣYr	Sp.	As	Cd	Cu	Hg	Ni	Pb	Se	Zn	tCdar	tDDT	tDielc	tPCB	tPAH	tBT
CBRP	Coos Bay	Russell Point	OR	8	me										D**		D*		D*
YBOP	Yaquina Bay	Oneatta Point	OR	8	me	D**	D**	D**									D*		D*
YHYH	Yaquina Bay	Yaquina Head	OR	7	mc														
TBHP	Tillamook Bay	Hobsonville Point	OR	8	me												D*		
CRSJ	Columbia River	South Jetty	OR	8	me			D**											
GHWJ	Grays Harbor	Westport Jetty	WA	8	mc	I**												D*	D*
JFCF	Juan de Fuca Strait	Cape Flattery	WA	7	mc							I**							
SSBI	South Puget Sound	Budd Inlet	WA	8	me		D**						D**						
CBTP	Commencement Ba	Tahlequah Point	WA	8	me			D**											D*
EBFR	Elliott Bay	Four-Mile Rock	WA	8	me			D**	D**		D**			D**	D**		D**		D**
SIWP	Sinclair Inlet	Waterman Point	WA	8	me			D**	D**		D*								D**
WIPP	Whidbey Island	Possession Point	WA	8	me				D**				D**						
BBSM	Bellingham Bay	Squalicum Marina	WA	8	me														D*
PRPR	Point Roberts	Point Roberts	WA	8	me							D*		D*		D*	D**		
PVMC	Port Veldez	Mineral Creek Flats	AK	7	me														
UISB	Unakwit Inlet	Siwash Bay	Ak	7	me	D**		D**			D**						D*		
HHKL	Honolulu Harbor	Keehi Lagoon	HI	6	os					I**									
BPBP	Barbers Point	Barbers Point Harb	HI	6	os							D**		D**		D**			

Table 6. Annual geometric mean concentrations of chemicals in mollusks for sites sampled in at least six years from 1986 to 1993. Concentration units: μg g^{-1}-dry for elements and ng g^{-1}-dry for organic compounds with ΣBT in terms of ng of Sn g^{-1}-dry. Last column is the Spearman rank correlation coefficient of concentration versus year with an asterisk (*) denoting statistical significance at the 95% level of confidence.

Chemical	1986	1987	1988	1989	1990	1991	1992	1993	r_s
As	10.2	9.8	9.4	8.5	9.5	9.1	9.3	8.5	-0.786*
Cd	3.1	2.9	2.7	2.6	2.8	2.7	2.1	2.5	-0.857*
Cu (mussels)	9.9	9.9	9.3	10	8.9	9	8.7	8.1	-0.810*
Cu (oysters)	110	110	130	120	150	120	130	120	0.294
Hg	0.11	0.11	0.11	0.12	0.09	0.11	0.11	0.12	0.429
Ni	2.1	2.1	1.9	1.7	1.7	2.1	2.3	1.7	-0.333
Pb (mussels)	2.1	2.2	2.1	1.7	1.9	2.1	1.6	1.7	-0.571
Pb (oysters)	0.42	0.53	0.49	0.45	0.55	0.6	0.5	0.59	0.667
Se	2.5	2.6	2.9	2.2	2.4	2.6	2.5	2.4	-0.381
Zn (mussels)	140	130	130	120	140	130	130	130	-0.291
Zn (oysters)	1800	1700	2100	2100	2300	1700	2000	1900	0.133
ΣCDANE	16	19	14	14	14	6.2	7.3	7.2	-0.886*
ΣDIELD	6.6	8.6	5.4	5.4	3.7	3	4.4	3.7	-0.810*
ΣDDT	39	46	39	42	36	20	26	25	-0.878*
ΣPCB	180	140	130	140	110	67	86	82	-0.833*
ΣPAH			350	310	270	250	280	300	-0.486
ΣBT				120	78	71	47	32	-1.000*

NS&T Mussel Watch Sites

Filled circles are sites sampled in
six or more years since 1986.

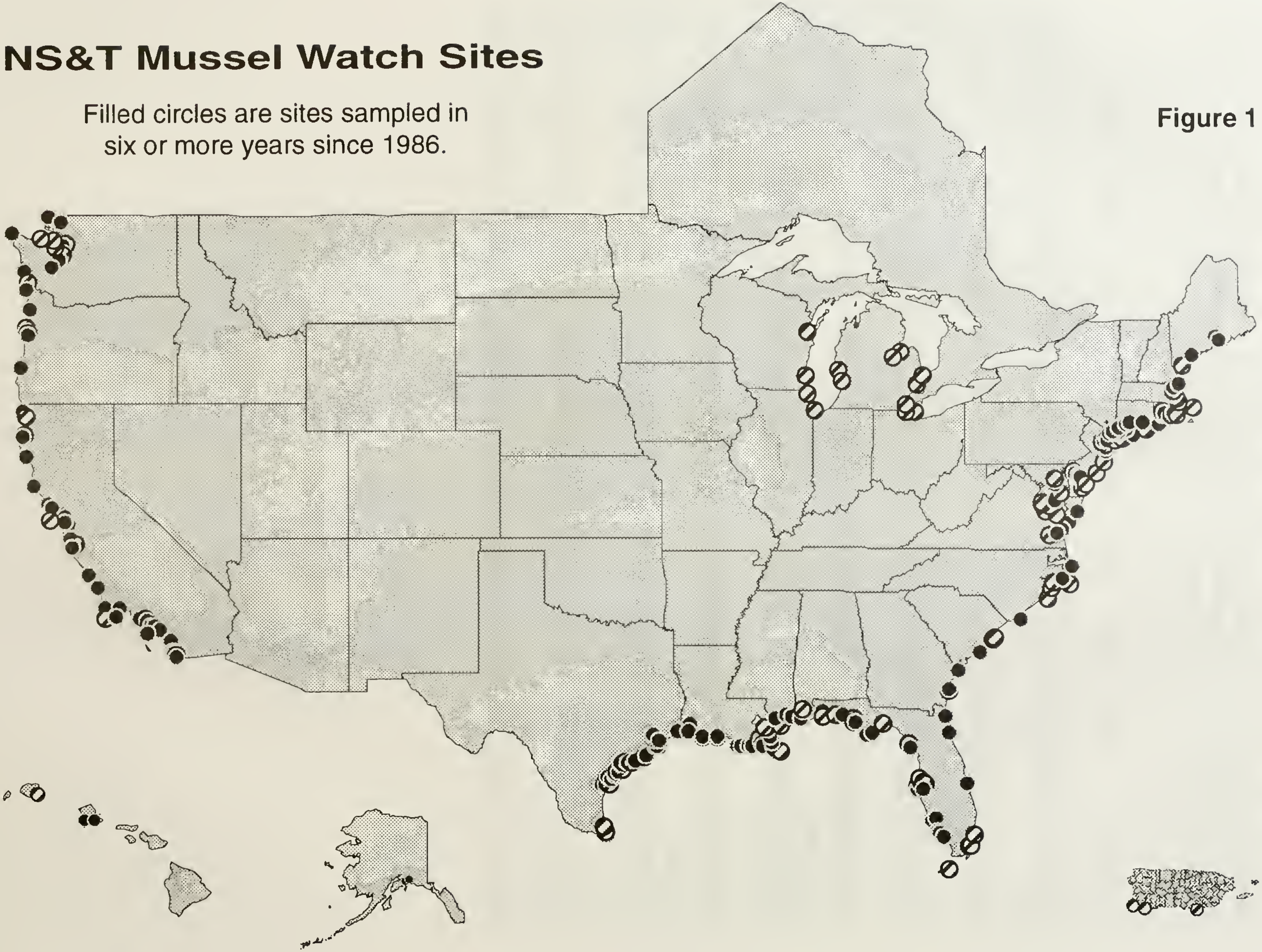
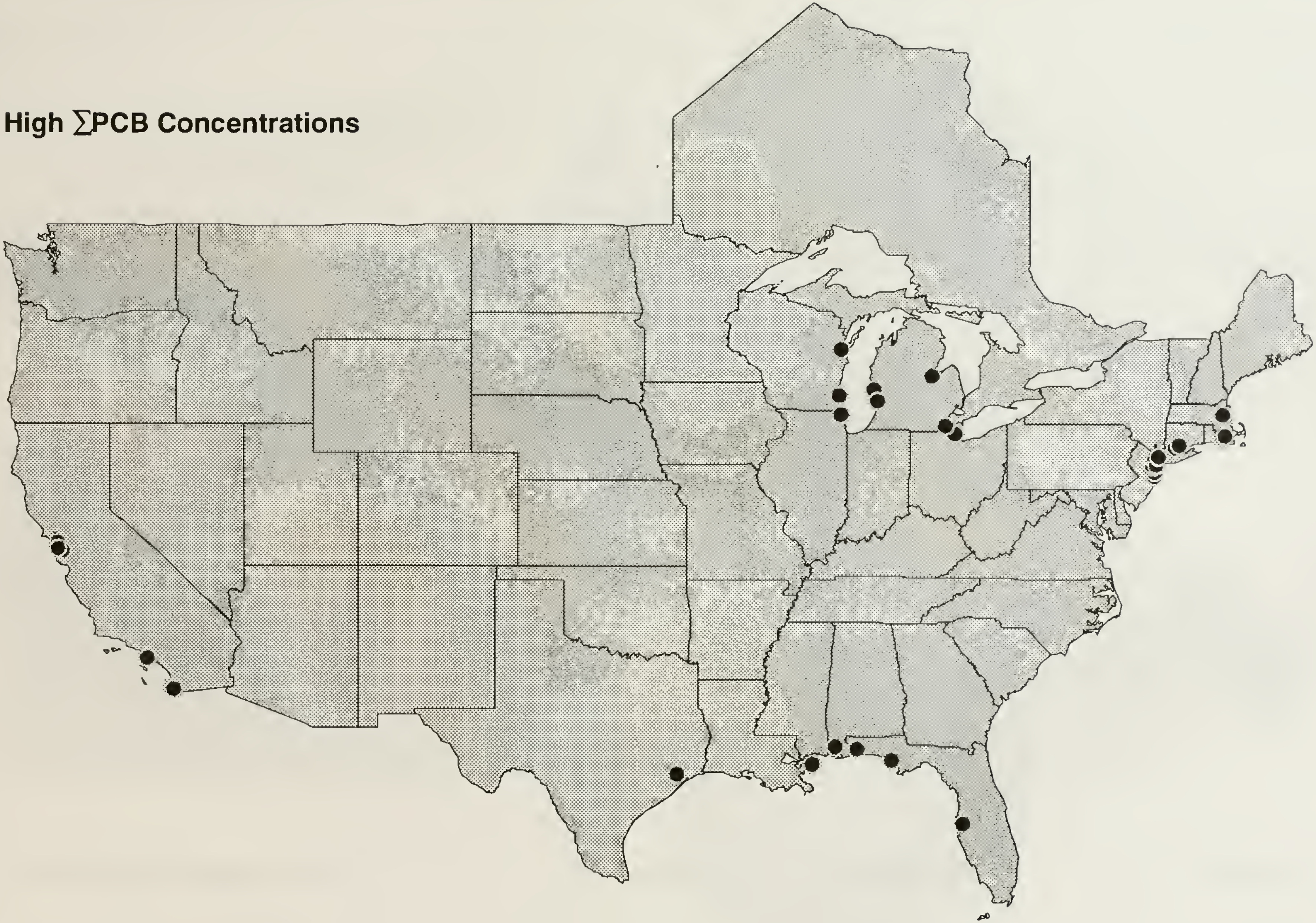


Figure 1

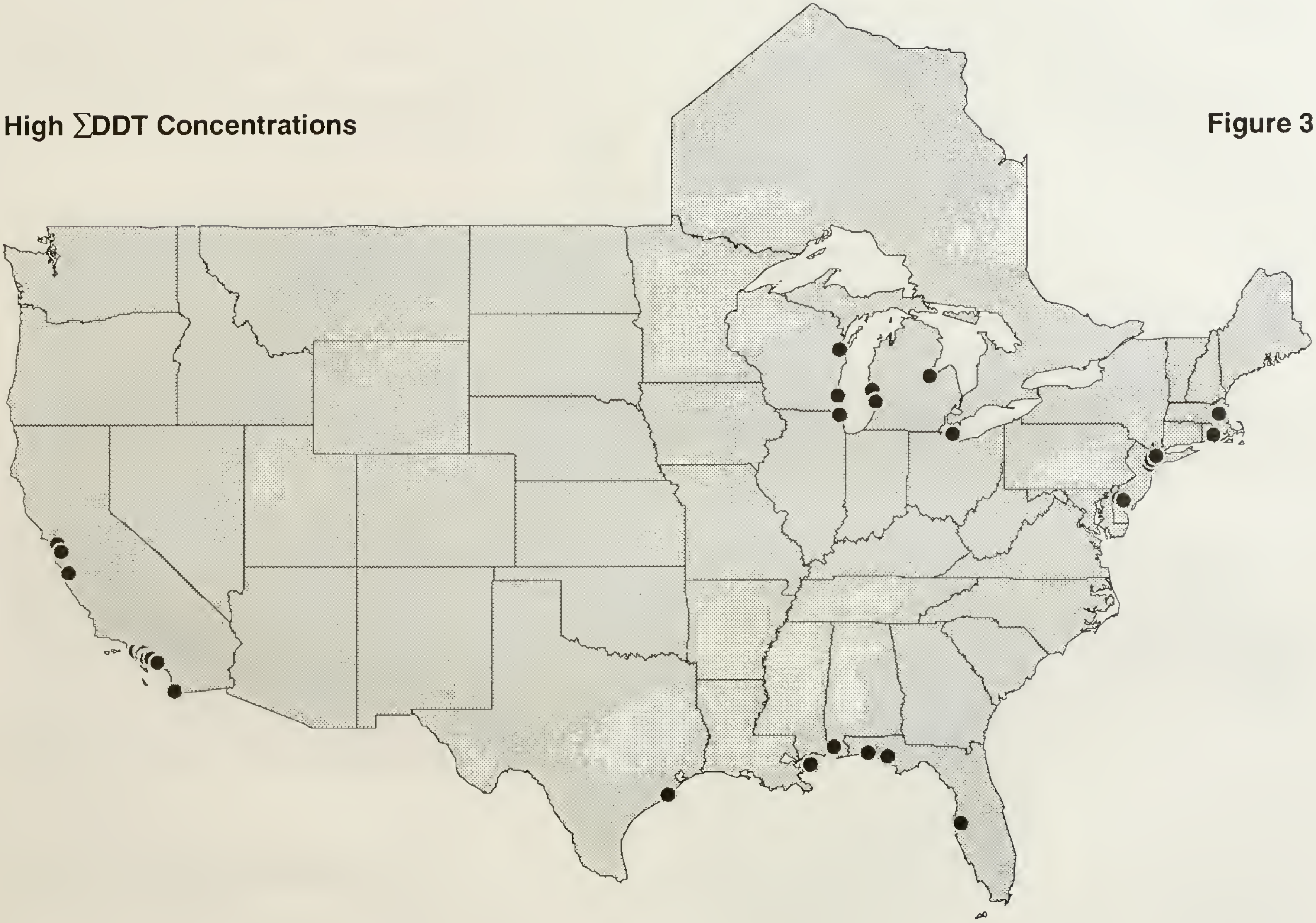


High ∑PCB Concentrations

Figure 2

High $\sum$DDT Concentrations

Figure 3



High ∑Chlordane Concentrations

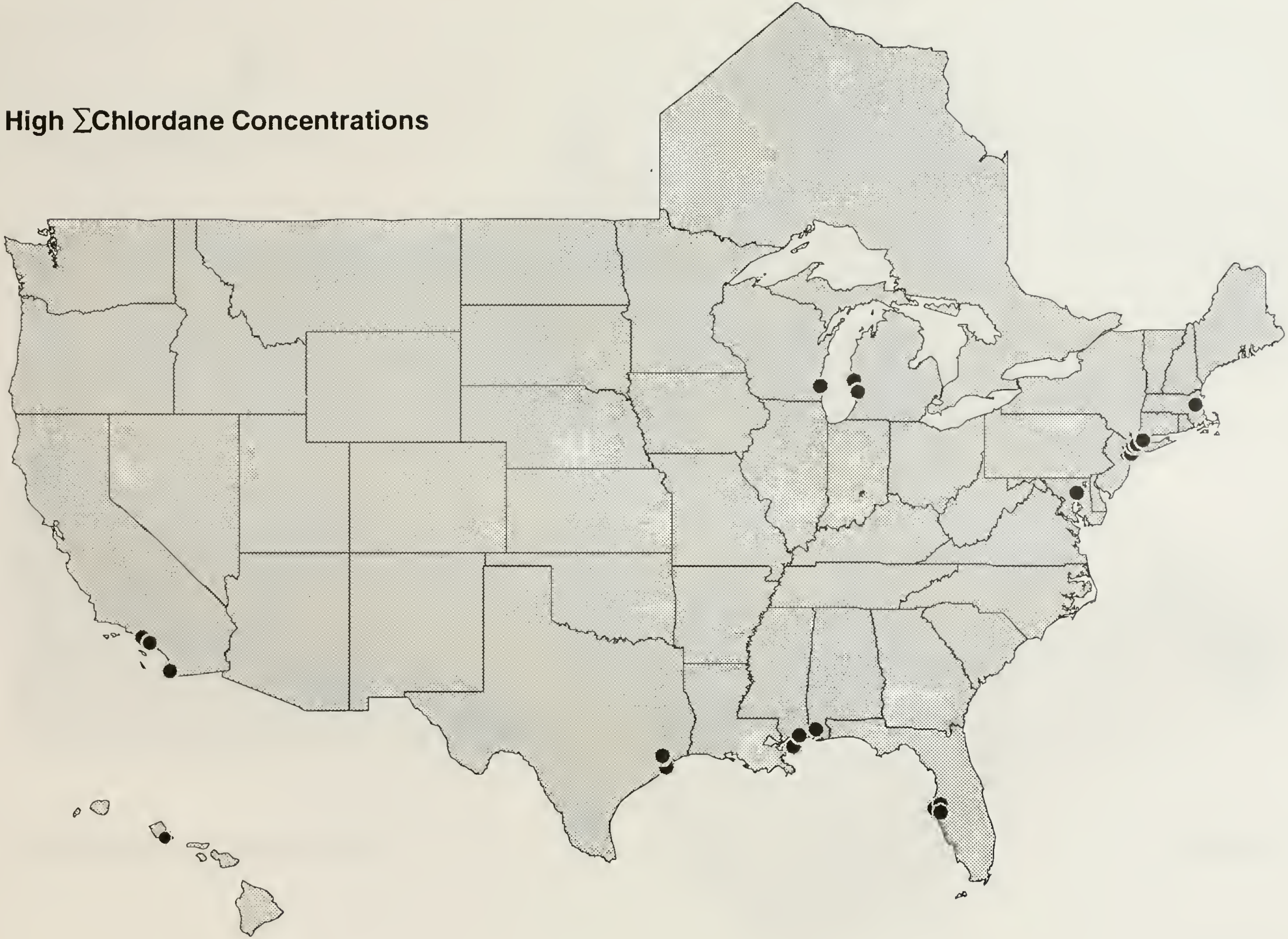
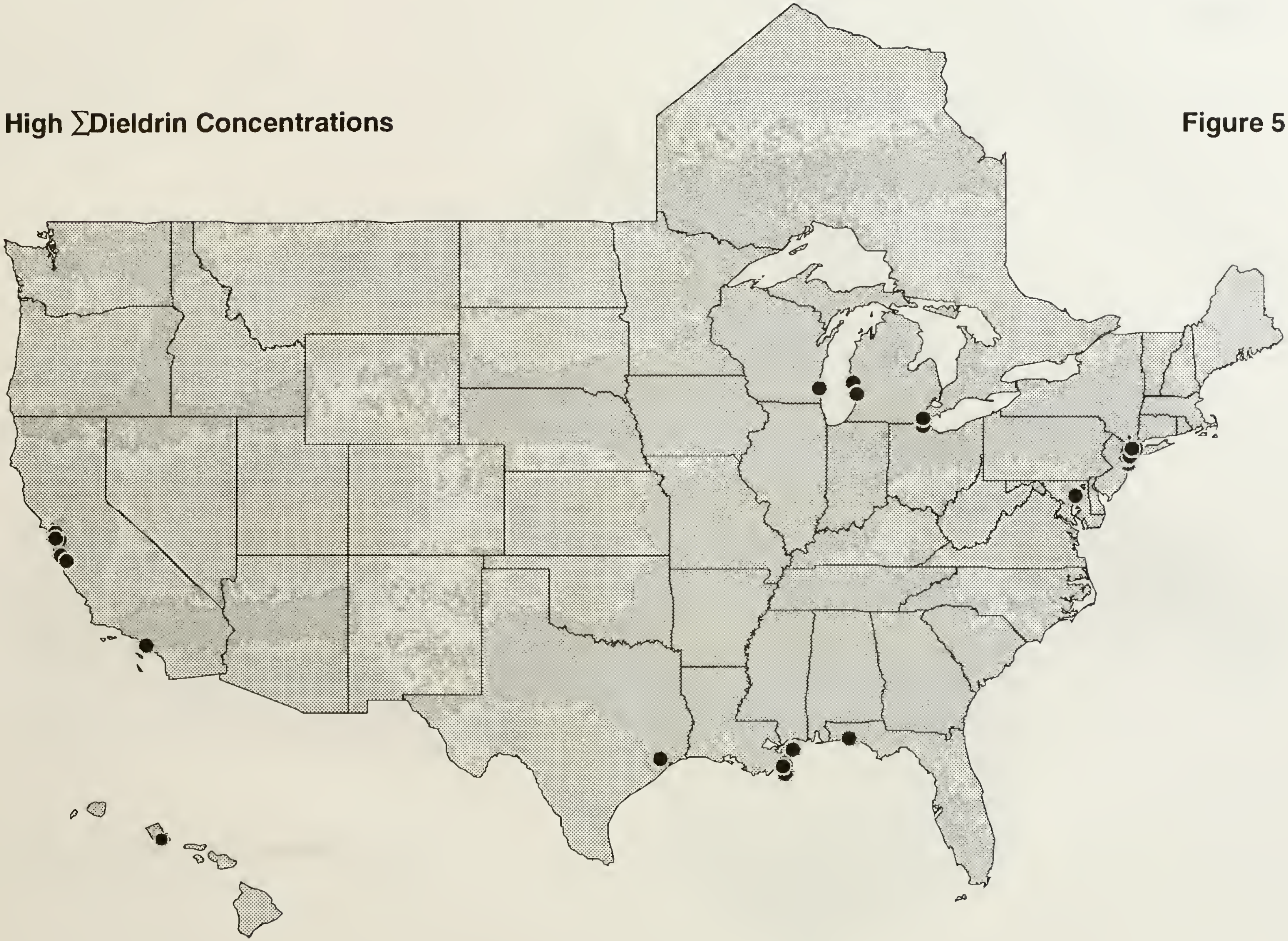


Figure 4

High $\sum$Dieldrin Concentrations

Figure 5



High $\sum$PAH Concentrations

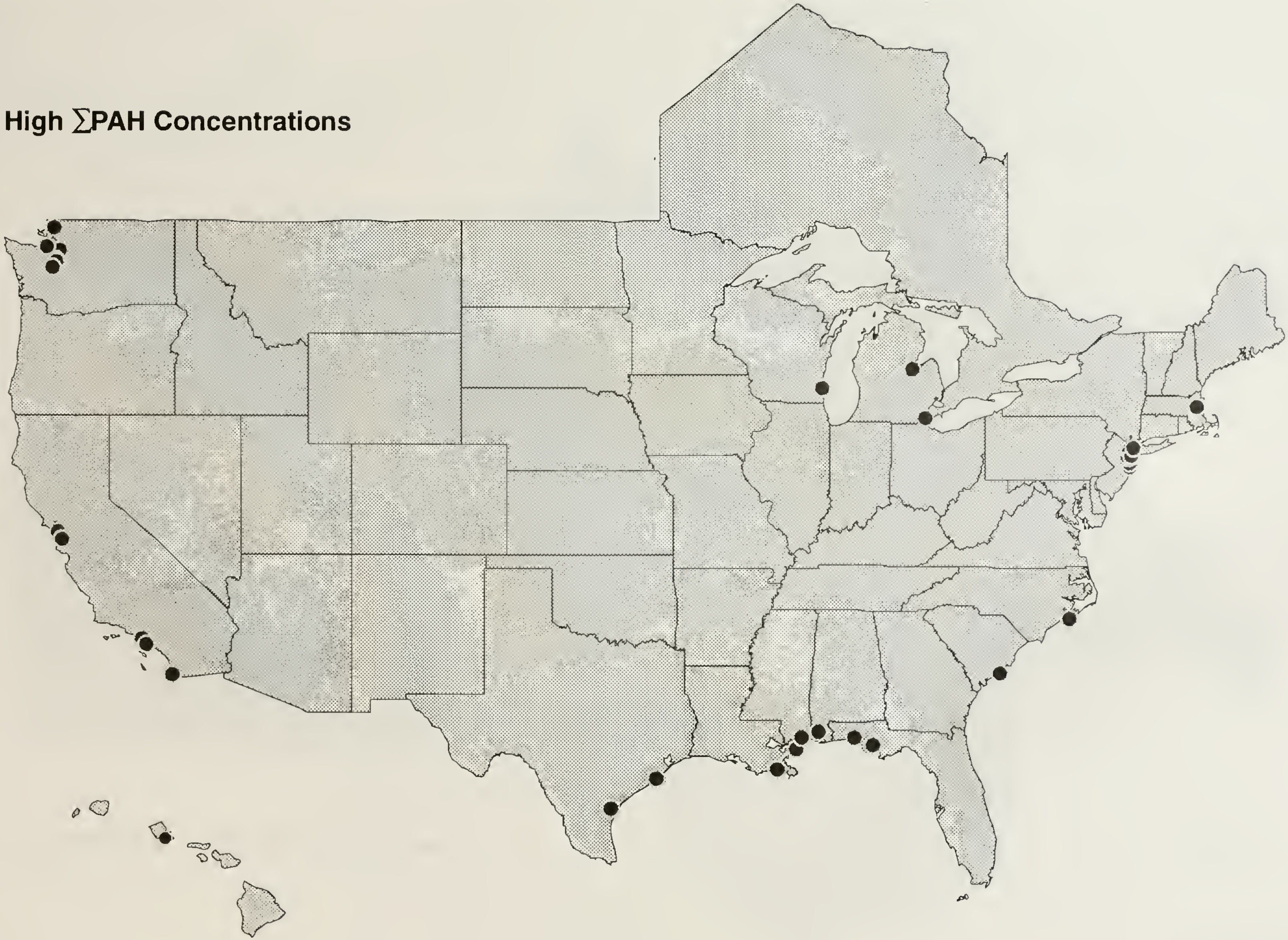
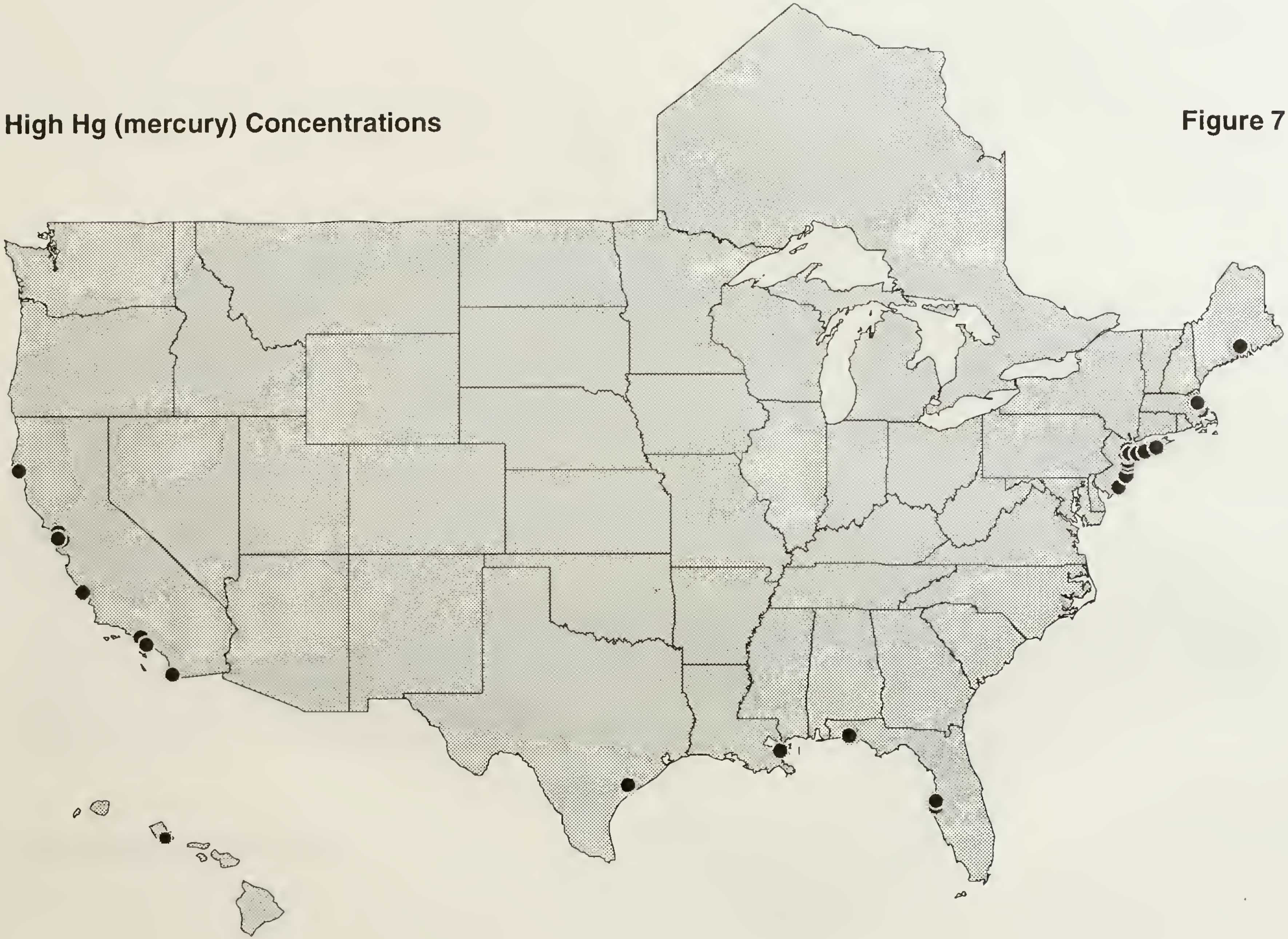


Figure 6

High Hg (mercury) Concentrations

Figure 7



High Zn (zinc) Concentrations

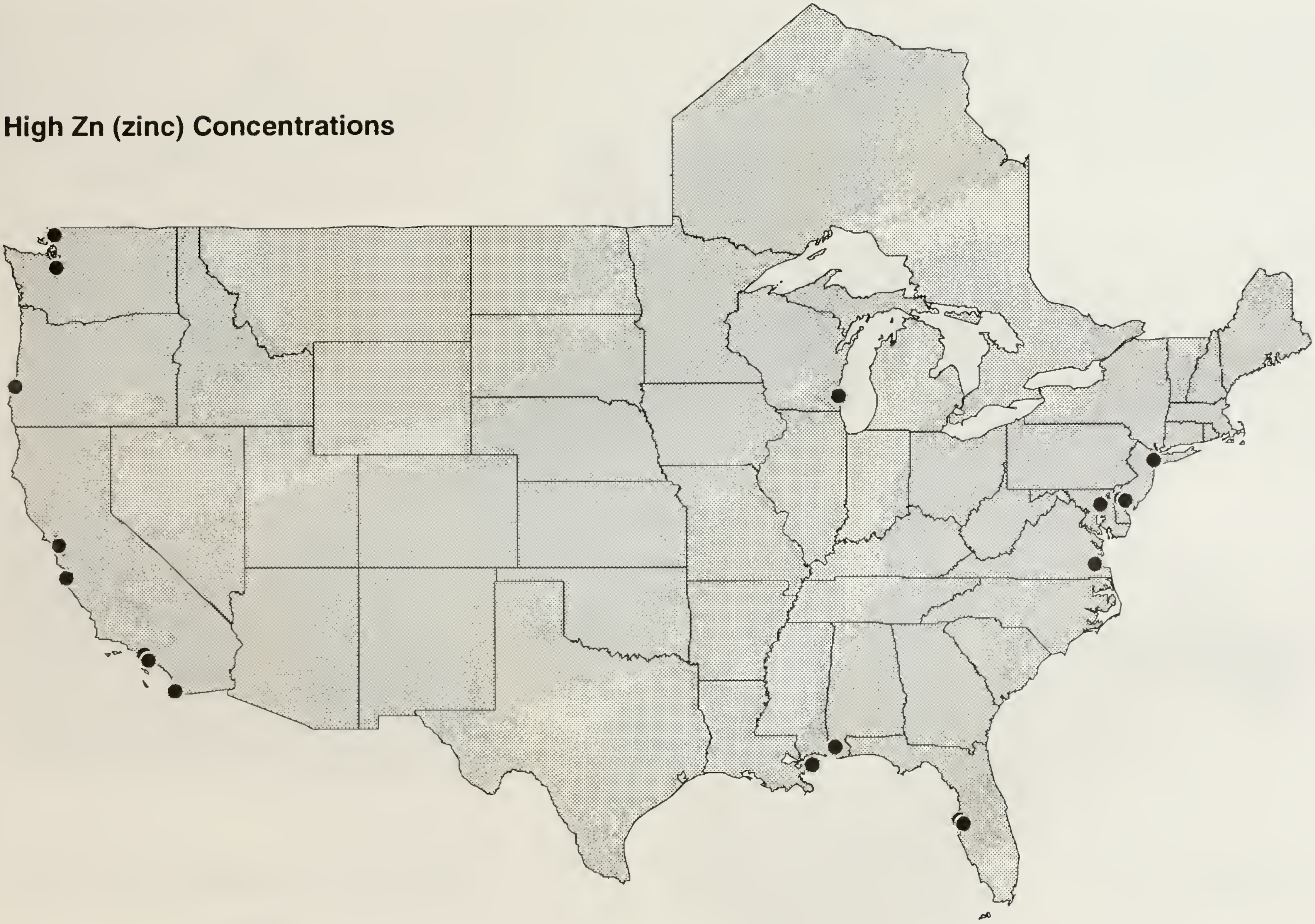
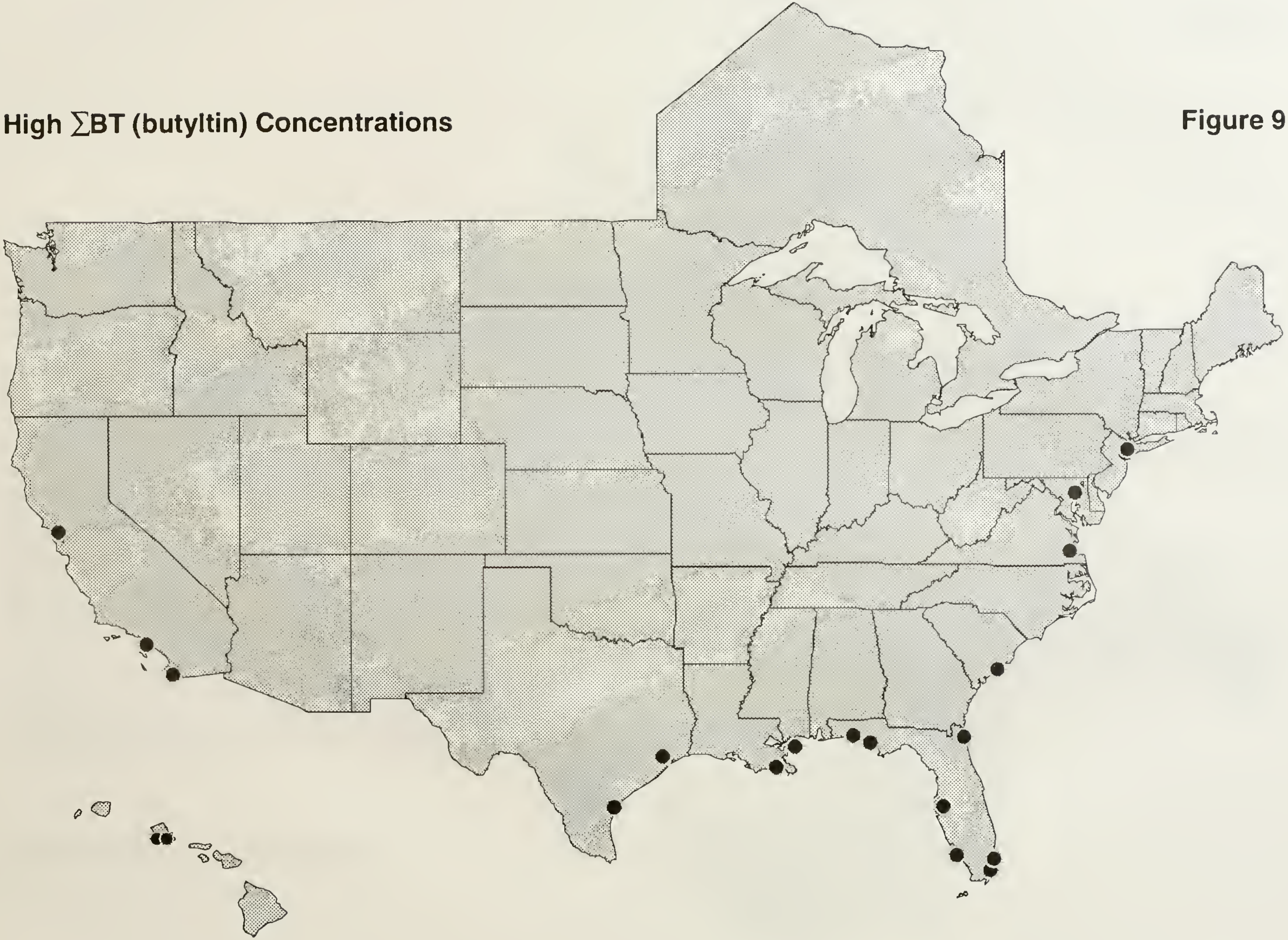


Figure 8

High ∑BT (butyltin) Concentrations

Figure 9



High Ni (nickel) Concentrations

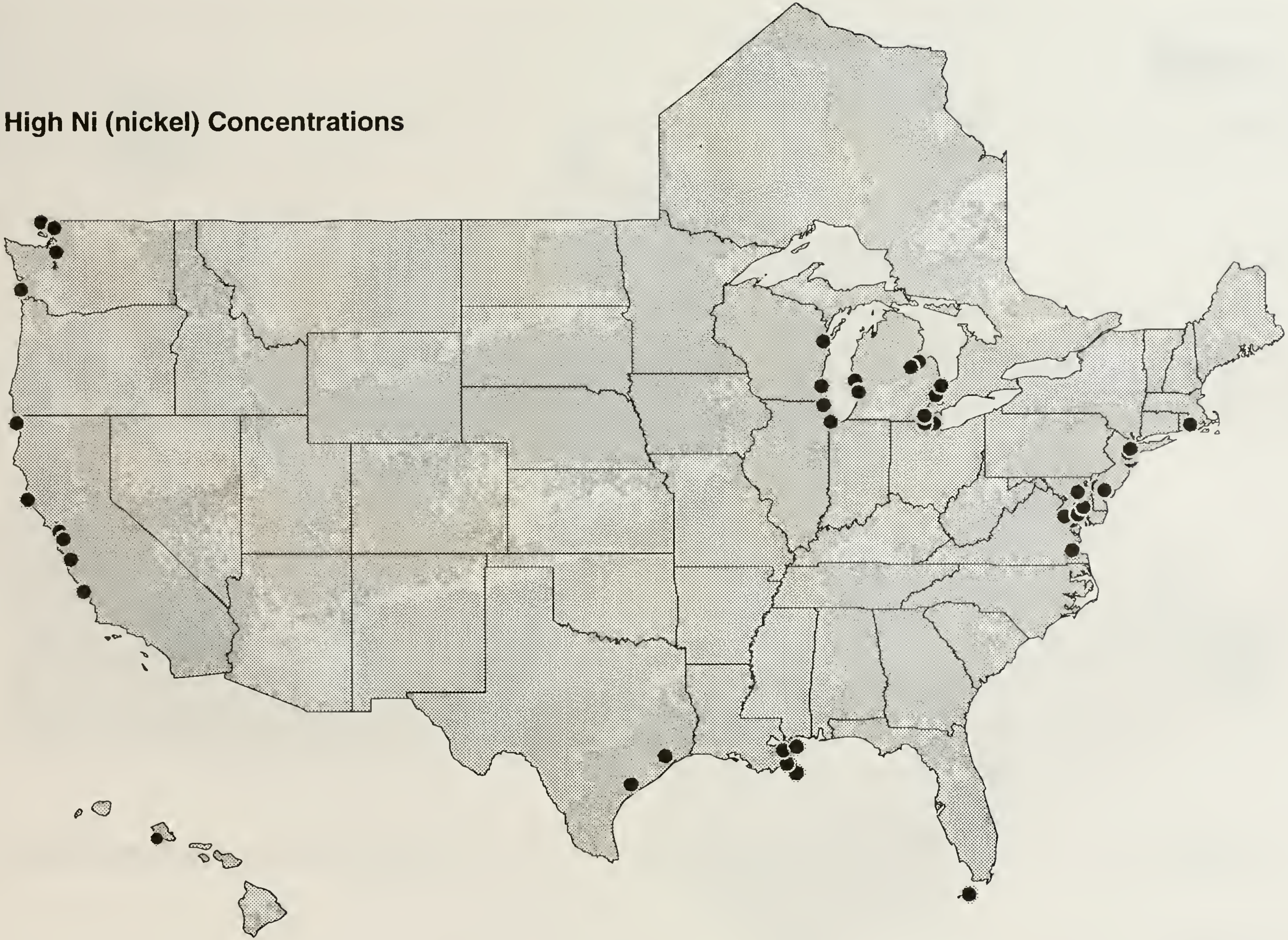
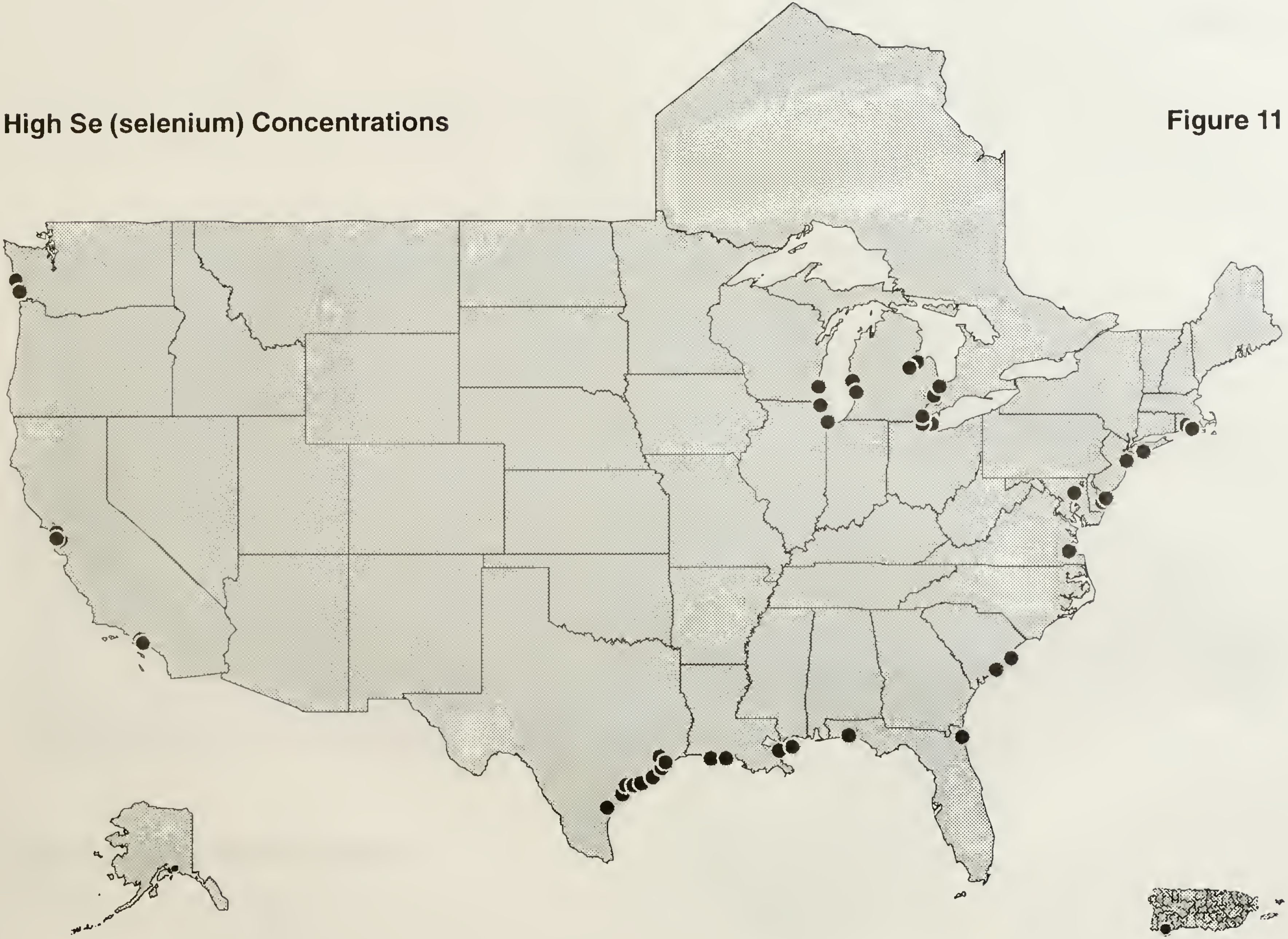


Figure 10

High Se (selenium) Concentrations

Figure 11



High Cu (copper) Concentrations

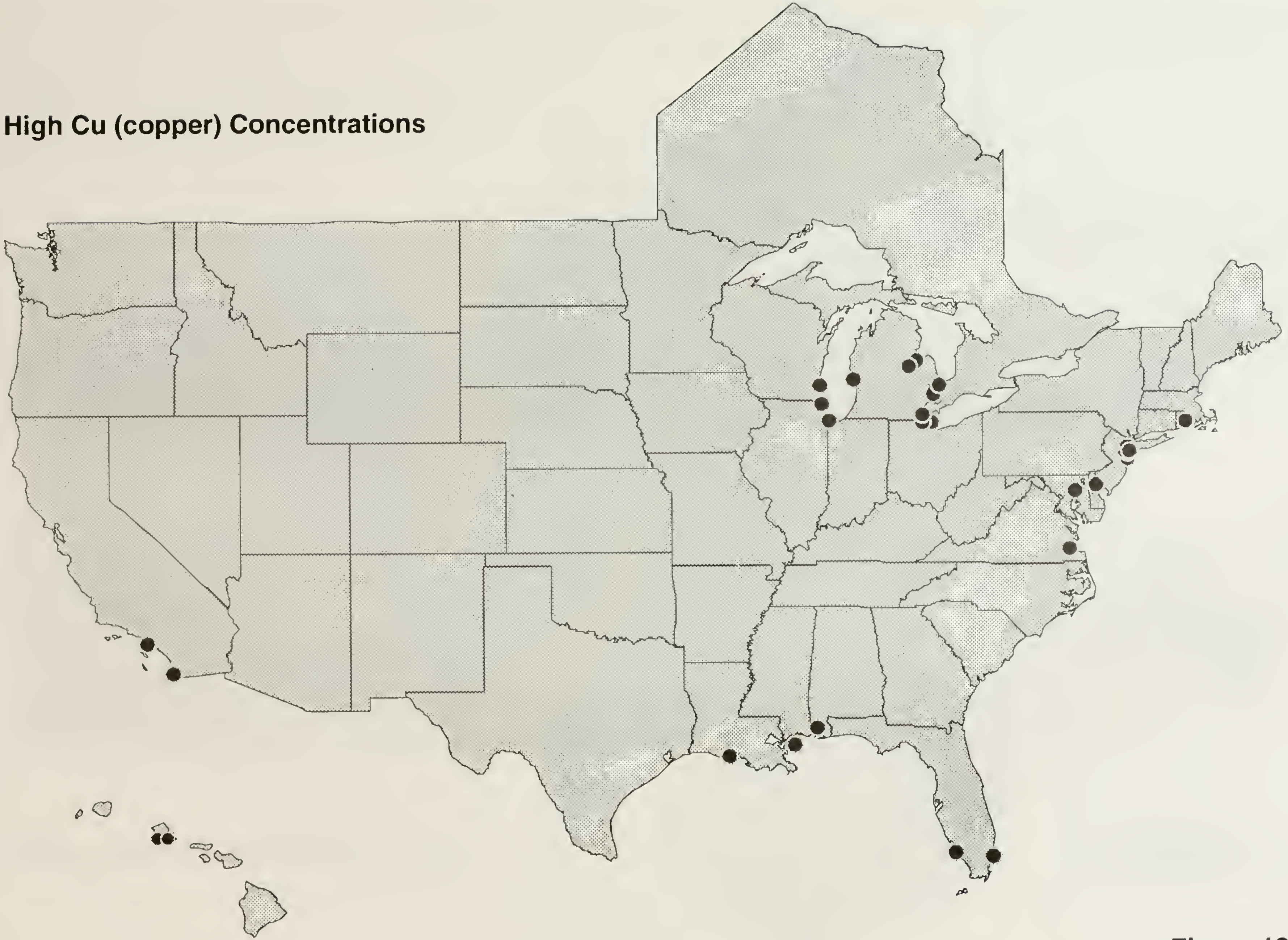
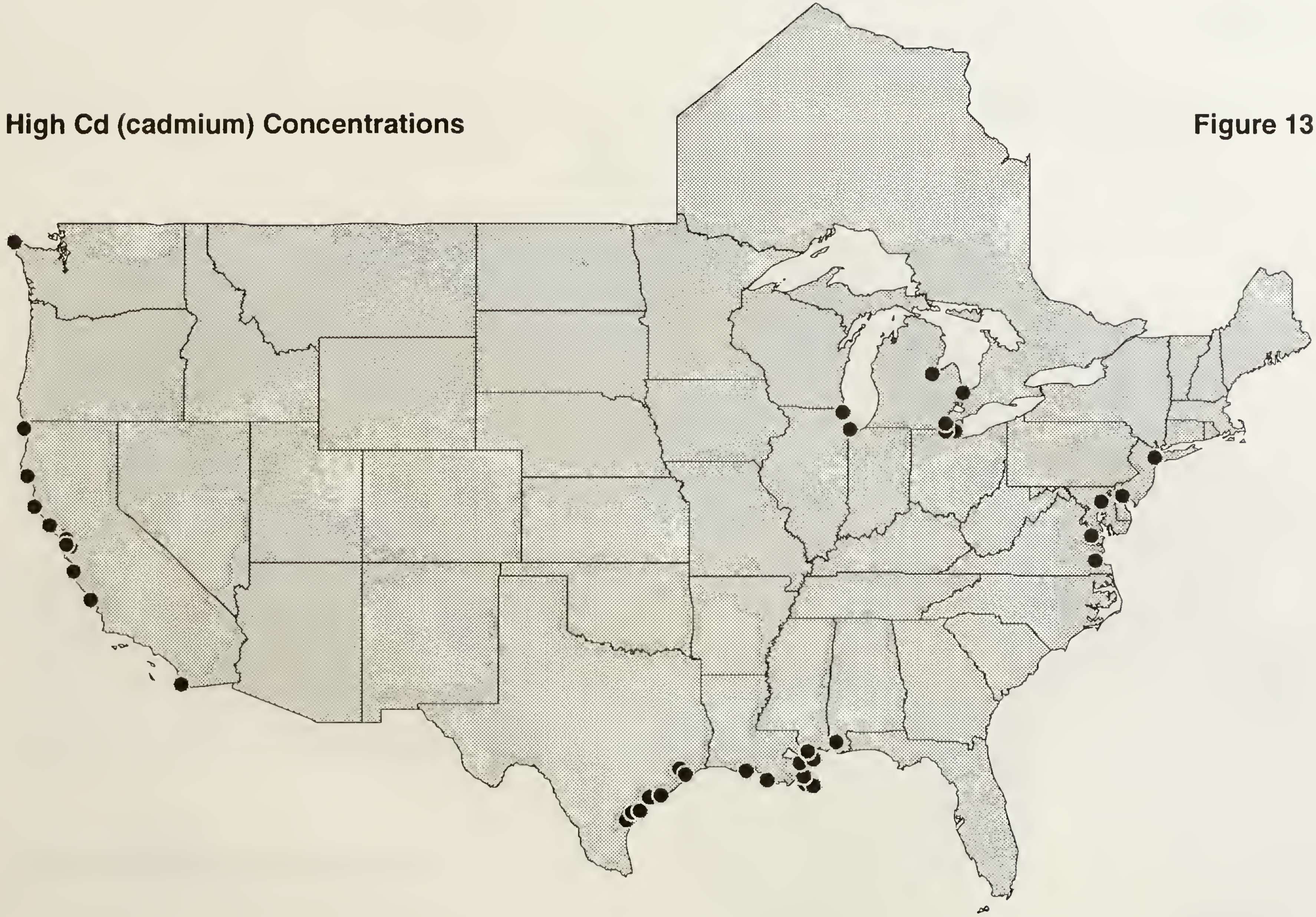


Figure 12

High Cd (cadmium) Concentrations

Figure 13



High As (arsenic) Concentrations

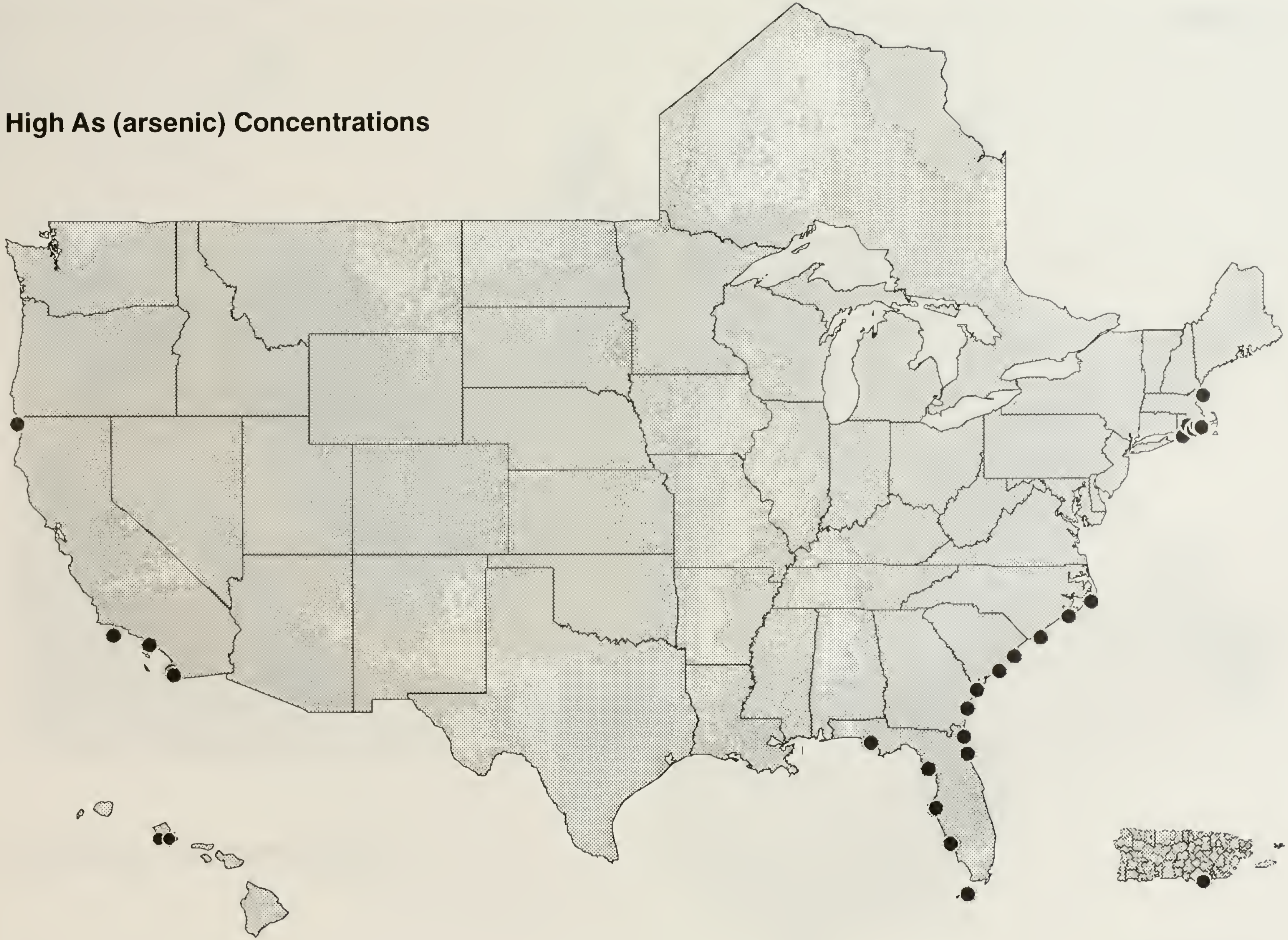


Figure 14

High Pb (lead) Concentrations

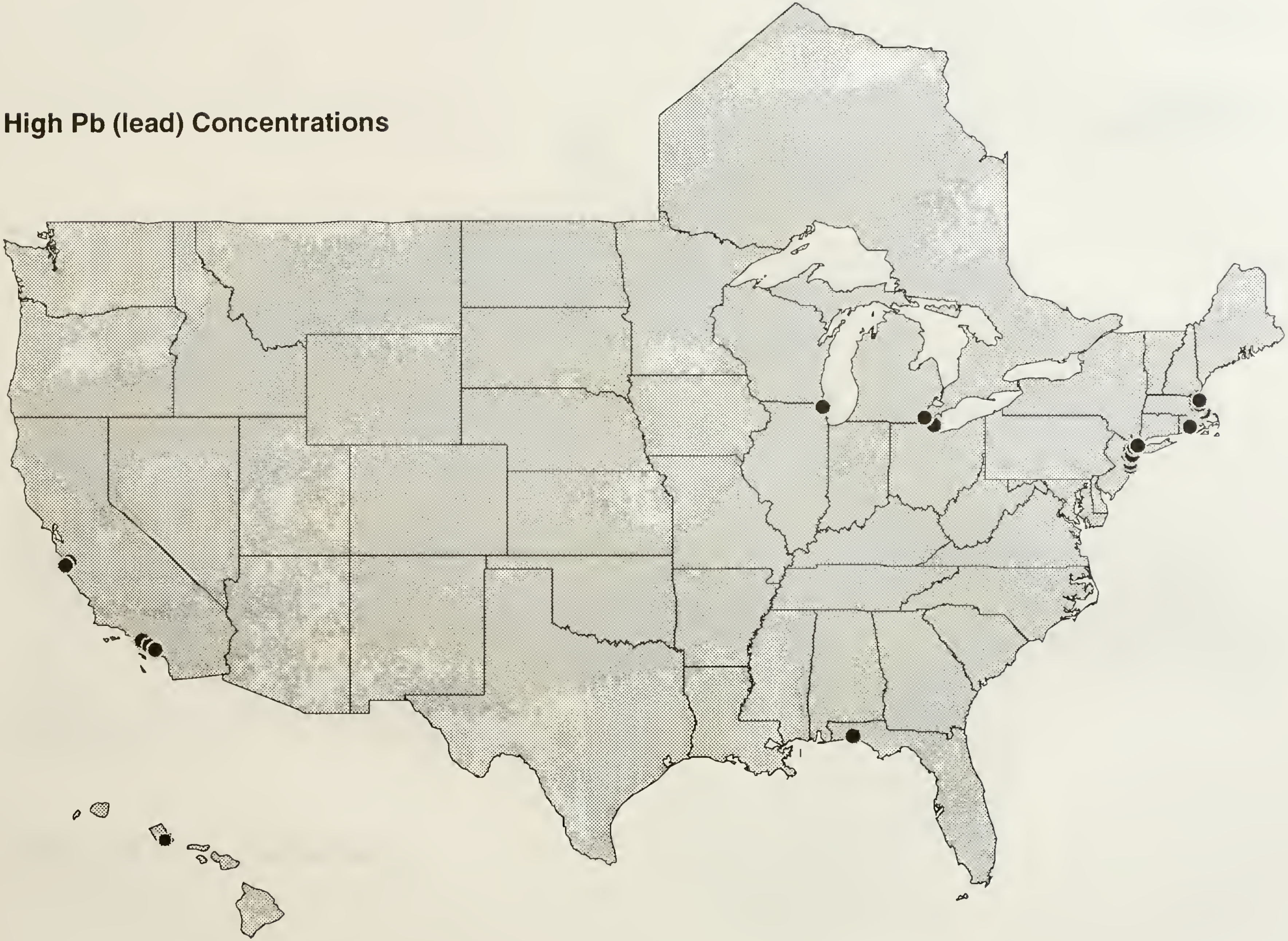


Figure 15

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